DOI:
10.1111/1468-2230.12748

Document Version
Publisher's PDF, also known as Version of record

Citation for published version (APA):
Schillig, M. A. (2022). 'Lex Cryptographi(c)a,' 'Cloud Crypto Land' or What? – Blockchain Technology on the Legal Hype Cycle. *Modern Law Review*, *86*(1), 31-66. Advance online publication. https://doi.org/10.1111/1468-2230.12748

THE MODERN LAW REVIEW
Modern Law Review
DOI: 10.1111/1468-2230.12748

'Lex Cryptographi(c)a,' 'Cloud Crypto Land' or What? – Blockchain Technology on the Legal Hype Cycle

Michael Anderson Schillig*

Based on the reception of DLT/blockchain, this article argues that legal discourse is subject to hype cycle dynamics. Thinking in hype cycle categories provides a structured way for analysing the legal implications of a particular innovation. This critical engagement with enthusiasts, sceptics and pragmatists through the different stages may help to present a more realistic picture of DLT/blockchain's potential from a legal perspective in the short and medium term. Consequently, this article discusses the potential for disruption to the legal system envisaged by enthusiasts at the height of inflated expectations, attempts to deconstruct the arguments levelled at the technology by its detractors during the trough of disillusionment, charts the emerging legal landscape that seeks to harness the potential of DLT/blockchain up the slope of enlightenment, and concludes by risking a glimpse towards the plateau of productivity.

INTRODUCTION

The Gartner Hype Cycle depicts a common pattern of market expectations for technological innovations over time. An 'innovation trigger' in the form of some technological breakthrough is followed by a 'peak of inflated expectations', before slower-than-expected adoption and lower-than-expected returns lead to a 'trough of disillusionment', out of which a 'slope of enlightenment' may lead to a 'plateau of productivity' where the real-world benefits result in mainstream adoption.[1] DLT/blockchain[2] is no different. When DLT/blockchain

*The Dickson Poon School of Law, King's College London. I am indebted to two anonymous reviewers and Roger Brownsword for insightful comments on an earlier draft. Any remaining mistakes are entirely my own. Research for this article has been generously supported by the British Academy in the form of a BA Mid-Career Fellowship. Except where otherwise stated, all URLs were last visited on 3 May 2022.

1 J. Fenn and M. Blosch, 'Understanding Gartner's Hype Cycles' 20 August 2018 at https://www.gartner.com/en/documents/3887767, also explaining the underlying methodology.

2 Blockchain technology and distributed ledger technology (DLT) are sometimes used interchangeably; however, their relationship is much more complex: M. Rauchs et al, *Distributed Ledger Technology Systems – A Conceptual Framework* (Cambridge: Cambridge Centre for Alternative Finance/University of Cambridge Judge Business School, 2019) (Cambridge Report) 19-24. The following categorisation is common: shared ledgers (as a form of shared database) can be divided into distributed ledgers and other shared (centralised) ledgers. Distributed ledgers can be divided further in to blockchain-based systems and other DLT systems, either one of which may be 'permissionless' so that in principle everybody can join and operate a validating node, or 'permissioned' in which case only entities that meet certain predefined conditions can join as network participants.

entered public consciousness at the height of the crypto craze of 2016–2017, an ever-increasing literature celebrated its transformative powers in technology, society and law. Blockchain was enthusiastically embraced as 'an important tool for protecting and preserving humanity'[3] and was said to be 'at the same level as the World Wide Web in terms of importance'.[4] Following the bursting of the 2017 crypto-bubble, critical voices became louder. According to Roubini, 'blockchain is the most over-hyped – and least useful – technology in human history'.[5] At the same time, the technology is quietly and tentatively being deployed by an increasing number of financial market participants[6] and the emerging decentralised finance (DeFi) ecosystem has generated renewed excitement.[7]

A similar trajectory can be observed in legal discourse. Early enthusiasts celebrated blockchain as accelerating 'a structural shift of power from legal rules and regulation administered by government authorities to code-based rules and protocols governed by decentralized blockchain-based networks'[8] and the emergence of a new *lex cryptographi(c)a*[9] with the potential to radically 'alter the existing distribution of social and economic power'.[10] More recently, sceptics have begun to dismiss blockchain as either 'useless or pointless'[11] and have characterised the 'promised blockchain legal revolution' as a 'damp, and regrettably widely distributed, squib'.[12] All the while, numerous jurisdictions have started to enact legal frameworks that seek to accommodate and facilitate the adoption of blockchain technology in various sectors, and courts have begun to

3 D. Tapscott and A. Tapscott, *Blockchain Revolution* (New York, NY: Penguin Business, 2016, updated 2019) 52.

4 W. Mougaya, *The Business Blockchain: Promise, Practice and Application of the Next Internet Technology* (Hoboken, NJ: Wiley, 2016) xix, xxi.

5 N. Roubini, 'Crypto is the Mother of All Scams and (Now Busted) Bubbles While Blockchain is the Most Over-Hyped Technology Ever, No Better than a Spreadsheet/Database' Testimony for the Hearing of the US Senate Committee on Banking, Housing and Community Affairs on 'Exploring the Cryptocurrency and Blockchain Ecosystem' October 2018 at https://www.banking.senate.gov/imo/media/doc/Roubini%20Testimony%2010-11-18.pdf.

6 On the Gartner Hype Cycle, blockchain technology in general has been hovering around the 'peak of inflated expectations' for the past few years, with 'Blockchain in banking and investment services' approaching the 'trough of disillusionment' in 2019: https://www.gartner.com/en/newsroom/press-releases/2019-09-12-gartner-2019-hype-cycle-for-blockchain-business-shows.

7 In addition, there is the rapidly increasing interest in blockchain-based non-fungible tokens (NFTs) mainly in the context of, but not limited to, digital art: U. Chohan, 'Non-Fungible Tokens: Blockchains, Scarcity and Value' Critical Blockchain Research Initiative Discussion Paper Series: Notes on the 21st Century, March 2021 at https://ssrn.com/abstract=3822743.

8 P. De Filippi and A. Wright, *Blockchain and the Law* (Cambridge, MA: Harvard University Press, 2018) 7.

9 This terminology was coined by P. De Filippi and A. Wright. Initially they used the term '*lex cryptographia*': A. Wright and P. De Filippi, 'Decentralized Blockchain Technology and the Rise of Lex Cryptographia' (2015) unpublished manuscript at http://ssrn.com/abstract=2580664; in their later book they switched to '*lex cryptographica*', De Filippi and Wright, n 8 above, 5-6.

10 K. Yeung, 'Regulation by Blockchain: The Emerging Battle for Supremacy between the Code of Law and Code as Law' (2019) 82 *Modern Law Review* 207, 208.

11 E. Schuster, 'Cloud Crypto Land' LSE Law, Society and Economy Working Papers 17/2019, 12-13.

12 K. Low and E. Mik, 'Pause the Blockchain Legal Revolution' (2020) 69 *International and Comparative Law Quarterly* 135, 175.

grapple with the application of core legal concepts to cryptoassets. It is submitted that an awareness of hype cycle dynamics in legal discourse may facilitate a more realistic appreciation of the innovative potential in law of new technologies.[13] DLT/blockchain is a particularly astute example: not only may this technology be a target of law and regulation,[14] but it may also be used as an alternative to, or displacement of,[15] law and legal ordering. Thinking in hype cycle categories provides a structured approach for a substantive analysis of the potential legal implications of a particular innovation. This critical engagement with enthusiasts, sceptics and pragmatists throughout the different stages helps to present a more realistic picture of DLT/blockchain's potential from a legal perspective in the short and medium term. This will allow regulators and policy makers to target the technology in a much more effective way, based on better information and evidence. Similarly, participants in the market for legal innovation will be better informed when deciding on a potential displacement of the traditional legal mechanisms with innovative regimes for normative ordering.

The following sections develop the conceptual framework, discuss the disruption to the legal system envisaged by enthusiasts at the height of inflated expectations, attempt to deconstruct the arguments levelled at the technology by its detractors during the trough of disillusionment, explore the emerging legal landscape that seeks to accommodate and harness the potential of blockchain technology up the slope of enlightenment, and conclude by risking a glimpse towards the plateau of productivity.

THE LEGAL HYPE CYCLE–METHODOLOGICAL CONSIDERATIONS

Since its inception in 1995,[16] the Gartner Hype Cycle has become one of the most influential consultancy models for advising corporate decision-makers on their technology strategies.[17] As an innovation matures, its hype cycle depicts a common pattern of surging and contracting expectations based on market participants' assessment of the innovation's future expected value.[18] Hype cycles provide a tool for organisations and investors to guide their decisions whether and when to adopt or invest in an innovation based on their respective risk appetite and business profile.[19]

13 L. Enriques and D. Zetsche, 'Corporate Technologies and the Tech Nirvana Fallacy' ECGI Working Paper N° 457/2019, July 2019, 25 at http://ssrn.com/abstract_id=3392321.
14 A. Butenko and P. Larouche, 'Regulation for Innovativeness or Regulation of Innovation?' TILEC Discussion Paper DP 2015-007 (2015) 11 at https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2584863.
15 H.-Y. Liu and others, 'Artificial Intelligence and Legal Disruption: A New Model for Analysis' (2020) 33 at https://core.ac.uk/download/pdf/334953293.pdf.
16 J. Fenn and M. Raskino, *Mastering the Hype Cycle* (Cambridge, MA: Harvard Business Press, 2008) xiii.
17 M. Steinert and L. Leifer, 'Scrutinizing Gartner's Hype Cycle Approach' in PICMET 2010 Proceedings (Piscataway, NJ: Institute of Electrical and Electronics Engineers, 2010) 254.
18 Fenn and Blosch, n 1 above, 4.
19 *ibid*, 9.

The hype cycle depicts the 'market's assessment of [an innovation's] future expected value'[20] ('expectations') as a function of time.[21] It combines a bell-shaped curve, representing the initial enthusiasm and disappointment driven by positive and negative hype, with an s-shaped curve, showing expectations based on how an innovation's performance improves slowly at first, to then accelerate and finally peter out with diminishing returns.[22] The former is initially caused by 'irrational exuberance', imagining the possibilities unencumbered by real experience, with expectations subsequently collapsing when early real-world experiences disappoint.[23] Then the s-curve sets in with a process of socialisation, adaptation and adoption to deliver real value, which inevitably takes longer than anticipated.[24]

Given that there is no standard measure of human 'expectations', hype cycle methodology relies on proxies,[25] notably the number of newspaper and magazine articles referring to an innovation ('visibility'), in combination with a qualitative assessment of various market signals,[26] relying primarily 'on the art of expert human judgment'.[27] Thus, what matters is not just the sheer amount of coverage but the prevalent tone of the stories in public discourse. The hype cycle can be plotted by gauging the prevalent sentiment as regards an innovation at a certain time. Peak-time stories abound with positive attributes and speculate about the innovation's future impact and transformational powers.[28] During the trough, the overall tenor of articles turns negative, highlighting the practical challenges and failures of early use cases.[29] Slope-narratives may focus on the maturing and expanding capabilities of an innovation in its newer iterations, incorporating the lessons learned from earlier failures.[30] Plateau-articles tend to highlight the many successful real-world applications, possibly with a view to identifying best practices.[31] The hype cycle model is not grounded in empirical science. There may be articles during peak-times that challenge an innovation's usefulness and negate its potential; others may seek to continue the hype throughout the trough. But the relative weight attributed to these 'contrarians' in the relevant discourse will be limited.[32] They will not get as much traction during these stages of the cycle. Conversely, although most articles may reinforce the same narrative, a single piece may fundamentally change the perception within the relevant discourse.[33] This relative prevalence and weight of a narrative within the relevant discourse largely depends on the significance of the pieces that support it, which is determined by many factors

20 Fenn and Raskino, n 16 above, 12.
21 *ibid*.
22 *ibid*, 26.
23 *ibid*, 26-35.
24 *ibid*, 35-45.
25 *ibid*, 12-13.
26 *ibid*, 13-14.
27 *ibid*, 14.
28 *ibid*, 73.
29 *ibid*, 75.
30 *ibid*, 79.
31 *ibid*, 85-86.
32 See for example A. Madrigal, 'The People Who Hated the Web Even Before Facebook' *The Atlantic* 15 March 2019.
33 Fenn and Raskino, n 16 above, 13.

including the reputation of the author and the medium of publication, but also (and perhaps most importantly) by a potential to inspire and spark the imagination of a significant number of participants.

Unsurprisingly, this methodological fussiness has engendered some criticism. First, it has been argued that there is no proven mathematical relation between the hype expectation bell curve and the technological maturity s-curve, so that the dependent variable cannot be operationalised or quantified.[34] This seems to be based on a misunderstanding. The hype cycle model combines the expectation bell curve with the expectations based on the maturity s-curve, not the maturity s-curve directly. 'Expectations' can be conceptualised as a function of both human nature (novelty preference, social contagion, decision heuristics) and actual technological maturity.[35] Secondly, studies seem to show that the evolution of various technologies has not followed the hype cycle model,[36] thus constituting contrary observable data.[37] However, the model seems sufficiently flexible to accommodate the observed patterns (waves of peaks and troughs; innovations never reaching the plateau of productivity). Although its flexibility renders the model non-falsifiable, this is irrelevant for a 'working management decision tool'[38] that seems to be good enough for solving the problems for which it has been developed.[39]

Are hype cycle dynamics discernible in law? The rich literature on regulatory competition[40] has shown that law can be a product subject to the dynamics of supply and demand and that there is a market for legal concepts and ideas amongst practising lawyers, regulators, legislators, courts and legal scholars. Legal ideas and concepts can be innovative in that they offer to tackle a certain social phenomenon in a 'better' way – more efficiently, effectively, with socially more desirable outcomes. Law is reactive; legal innovation will usually be triggered by an exogenous event – a corporate scandal, a financial crisis or a new technology. For example, in the aftermath of the Global Financial Crisis, the power to impose losses on shareholders and creditors ('bail-in') was hailed as the cure to prevent future bailouts; early experience has been disappointing however, and bail-in is unlikely to have the ground-breaking effect initially envisaged.[41] The relationship between technological innovation and legal innovation is complex. First, technological innovation may be the 'target'

34 Steinert and Leifer, n 17 above, 257-258; O. Dedehayir and M. Steinert, 'The hype cycle model: A review and future directions' (2016) 108 *Technological Forecasting and Social Change* 28, 33.

35 Initially, product maturity is at an embryonic stage, but enthusiasm for the 'new' drives expectations; later, when novelty has worn off, product maturity may have progressed, resulting in more realistic expectations.

36 Steinert and Leifer, n 17 above; Dedehayir and Steinert, n 34 above.

37 Steinert and Leifer, *ibid*, 265. The hype cycle may thus be rejected as a general model: K. Popper, *The Logic of Scientific Discovery* (London: Routledge, 2005) 65-68.

38 Fenn and Bosch, n 1 above, 17.

39 Popper, n 37 above, 72: 'We frequently work with statements which, although actually false, nevertheless yield results which are adequate for certain purposes.'

40 Seminal: W. Cary, 'Federalism and Corporate Law: Reflections Upon Delaware' (1974) 83 *Yale Law Journal* 663; R. Romano, 'Law as a Product: Some Pieces of the Incorporation Puzzle' (1985) 1 *Journal of Law, Economics & Organization* 225.

41 M. Schillig, 'EU Bank Insolvency Law Harmonisation: What Next?' (2021) 30 *International Insolvency Review* 239.

of law and regulation. With Butenko and Larouche, 'regulation for innovation' may be distinguished from 'regulation of innovation'. The former concerns the legal environment within which technological innovation occurs which may steer innovation in specific directions and away from others.[42] By contrast, law and 'regulation of innovation' seek to maximise an innovation's positive effects and minimise its negative effects on society, whilst ensuring compliance with the community's fundamental values and public policy goals.[43] In this context, technological innovation may result in 'legally disruptive moments' caused by new capabilities or behavioural patterns that reveal the inconsistency, inappropriateness or incompleteness of the existing legal system.[44] Legal innovation may take the form of a (re-)interpretation or clarification of a pre-existing framework or the introduction of a new regulatory regime to address any shortcomings of the status quo.[45] However disruption may also consist of new capabilities for legal actors, including policymakers, regulators, and market participants, to produce and enforce alternative normative frameworks, thereby gradually 'displacing' certain existing legal mechanisms in functional terms.[46] This second form of technology-engendered legal innovation may be termed 'legal displacement'[47] or 'technological management'.[48] Both as target and displacement, technological innovations generate potentially transformative legal innovations which then follow hype cycle dynamics within the relevant legal reference community, whereby legal and regulatory interventions may in turn shape the course of technological development. The trajectory from 'lex informatica' and 'code is law' in cyberspace towards a much more traditional and very effective regulation of internet intermediaries and its impact on the technology itself has been charted in Laurence Lessig's seminal work.[49] Like the internet or Artificial Intelligence, blockchain technology combines both dimensions: it can, and has been, the target of law and regulation;[50] but, perhaps more importantly, it also has the potential to supplement or displace traditional legal ordering.[51]

42 Butenko and Larouche, n 14 above, 5-6.
43 *ibid*, 11-12.
44 Liu and others, n 15 above, 17, 23-24.
45 *ibid*, 25.
46 *ibid*, 33.
47 *ibid*.
48 R. Brownsword, *Law 3.0* (Abingdon: Routledge, 2021); R. Brownsword, 'Regulatory Fitness: Fintech, Funny Money and Smart Contracts' (2019) 20 *European Business Organization Law Review* 5, 11-14; R. Brownsword, 'Smart Contracts: Coding the Transaction, Decoding the Legal Debates' in P. Hacker, I. Lianos, G. Dimitropoulos and S. Eich (eds), *Regulating Blockchain* (Oxford: OUP, 2019) 311, 312-318.
49 L. Lessig, *Code version 2.0* (New York, NY: Basic Books, 2006).
50 For example R. Grinberg, 'Bitcoin: An Innovative, Alternative Digital Currency' (2012) 4 *Hastings Science & Technology Law Journal* 159; N. Plassaras, 'Regulating Digital Currencies: Bringing Bitcoin within the Reach of the IMF' (2013) 14 *Chicago Journal of International Law* 377; S. Middlebrook and S.J. Hughes, 'Regulating Crytpocurrencies in the United States: Current Issues and Future Directions' (2014) 40 *William Mitchell Law Review* 813; A. Yee, 'Internet Architecture and the Layers Principle: A Conceptual Framework for Regulating Bitcoin' (2014) 3 *Internet Policy Review* 1.
51 P. De Filippi and S. Hassan, 'Blockchain technology as a regulatory technology: From code is law to law is code' (2016) 21 *First Monday*, 10-11 at https://firstmonday.org/ojs/index.php/fm/article/download/7113/5657: 'having an effect similar to law is the primary function of smart contract code.'

A 'blockchain' is a particular data structure that allows for the secure timestamping of digital information and the creation of peer-validated decentralised systems for secure value transfers without central control.[52] The relevant data items are published across a decentralised network and locally stored at every participating node so that any new transactions can be checked and verified against the local copy of the entire chain. This requires agreement on a single version of the transaction history by way of a decentralised consensus mechanism (proof-of-work,[53] proof-of-stake,[54] Byzantine Fault Tolerance[55]). Machine-readable instructions ('smart contracts') can be run by participating nodes and track and store the resulting state changes,[56] allowing parties to automate the performance of 'state-contingent' transactions that follow a deterministic 'if X then Y' logic.[57] As the internet of value, blockchain offers an alternative system for the attribution and transfer of value; the blockchain protocol with its embedded code replaces the (traditional) legal order's property rights symbolism[58] – value is defined, tracked and allocated in an alternative

52 P. Tasca and C. Tessone, 'Taxonomy of Blockchain Technologies. Principles of Identification and Classification' (2017) 2 at https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2977811; S. Nakamoto, 'Bitcoin – A Peer-to-Peer Electronic Cash System' (2008) 1 at https://www.ussc.gov/sites/default/files/pdf/training/annual-national-training-seminar/2018/Emerging_Tech_Bitcoin_Crypto.pdf. The underlying technology has been explained extensively for legal audiences; a short summary must suffice here; for a comprehensive assessment, see J. Bacon, J. Michels, C. Millard and J. Singh, 'Blockchain Demystified: A Technical and Legal Introduction to Distributed and Centralised Ledgers' (2018) 25 *Richmond Journal of Law & Technology* 1; for a short introduction: De Filippi and Wright, n 8 above, 13-57.

53 (Some) participating nodes (miners) expand computing power to solve a 'cryptographic puzzle' (in the form that the hash of a new block must fall within a certain target range) by trial-and-error: the transaction data of the new block and the hash of the previous block are repeatedly hashed together with a changing random variable (*nonce*) until the hash is within the prescribed range. Miners will work on, and seek to add to, the longest chain of blocks so that consensus is achieved around the transaction history that has absorbed the greatest amount of computing power: Nakamoto, *ibid*, 2.

54 Validators deposit a certain amount of the native token (say ETH) in a special smart contract account; random committees of validators will be selected to propose and vote on the next block, with voting power of each validator being determined by the amount of ETH they put at stake. If a block is accepted by the majority, the proposing validator will be rewarded in proportion to her deposited stake; conversely, if a block is rejected the validator risks losing his deposit. Arguably, this incentivises validators to act loyally with punishment being dished out intrinsically to the blockchain, whereas with proof-of-work punishment is extrinsic in form of costs for electricity and hardware. See A. Antonopoulos and G. Wood, *Mastering Ethereum* (O'Reilly, 2019) 321

55 BFT algorithms are able to operate in the presence of malicious network participants. The upper limit of corrupted nodes that practical BFT algorithms can tolerate is f in a network consisting of 3f+1 nodes, or less than 1/3 of the nodes; M. Vukolic, 'The Quest for Scalable Blockchain Fabric: Proof-of-Work vs. BFT Replication' in J. Camenisch and D. Kedogan (eds), *Open Problems in Network Security: Lecture Notes in Computer Science* (Zurich: Springer, 2016) 112, 118-119.

56 Antonopoulos and Wood, n 54 above, 6-8.

57 D. Awrey, 'Split Derivatives: Inside the World's Most Misunderstood Contract' (2019) 36 *Yale Journal of Regulation* 495, 499.

58 K. Pistor, *The Code of Capital* (Princeton, NJ: Princeton University Press, 2019) 3: 'financial instruments … exist only in law'; K. Pistor 'A legal theory of finance' (2013) 41 *Journal of Comparative Economics* 315, 317: 'markets themselves, just like financial intermediaries, are constructed in law and do not exist outside it.'

way. At the same time, blockchain constitutes a transaction infrastructure[59] that can facilitate the creation, attribution and transfer of traditional property rights. As such, it requires a legal underpinning and will be subject to legal constraints. Thus, blockchain technology is conducive to partially supplanting and/or supplementing the legal order ('displacement'), whilst also being the 'target' of law and regulation with the regulatory state asserting its sovereign power.[60] Given blockchain's bidimensional impact on legal innovation, it is not surprising to see hype cycle dynamics within the legal discourse.[61]

The concept of the legal hype cycle adds a new perspective to the literature that seeks to elucidate the interaction of law and technology in general, and law and blockchain in particular. The participants in the legal discourse – including practicing lawyers, regulators, policymakers and academics – are themselves subject to hype cycle dynamics. To the extent that they are aware and understand the driving forces behind the hype cycle, they will be in a better position to avoid some of the inherent pitfalls and exploit the opportunities that may arise.[62] Both peaks and troughs are, to a large extent, driven by 'irrational' decision heuristics.[63] Availability bias is a well-documented phenomenon in behavioural law and economics. The ready availability of certain information may produce systematic errors in the sense that decision makers are likely to pervasively overestimate or underestimate the relevance of a certain phenomenon, resulting in a huge demand for (over-)regulation or for regulatory complacency and forbearance.[64] This tendency is reinforced by confirmation bias in the sense that people systematically seek out and collect information that confirms their existing preferences and tend to overlook or dismiss evidence to the contrary.[65] With an appreciation that these forces drive the legal hype cycle, technocratic enthusiasm during peak times can be viewed from a sobering distance with critical voices to be heard and properly considered.[66] On that basis, the transformative potential of an innovation is likely to fall far short of expectations at this stage, where little is known and has been accomplished. As the innovation

59 G. Dimitropolous, 'The Law of Blockchain' (2020) 95 *Washington Law Review* 1117, 1151-1171; K. Werbach, *The Blockchain and the New Architecture of Trust* (Cambridge, MA: MIT Press, 2018) 54.

60 Yeung, n 10 above, 208.

61 'Visibility' as a first and limited proxy measure can be gauged by looking at the number of articles that a free text search on Westlaw UK returns for 'Bitcoin, blockchain, Ethereum and/or "distributed ledger"' over the years since Bitcoin's inception in 2009:

Year	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
	0	0	2	2	18	47	42	61	106	187	152	138

The 2018/2019 peak seems to nicely coincide with the 2017 crypto-craze, taking into account the time-lag of publication.

62 Fenn and Raskino, n 16 above, 63-64.

63 *ibid*, 33-35.

64 C. Sunstein 'Behavioural Analysis of Law' (1997) 64 *University of Chicago Law Review* 1175, 1188.

65 Fenn and Raskino, n 16 above, 34.

66 A. Walch, 'The Path of the Blockchain Lexicon (and the Law)' (2017) 36 *Review of Banking and Financial Law* 713, 753-762 advocating for a 'critical mindset' when learning about blockchain with a view to separating 'hype from reality.'

moves along the legal hype cycle, better information will become available so that regulatory intervention can be grounded in evidence and the risk of regulatory Type I errors (intervening when unnecessary) can be reduced.[67] Consequently, policymakers and regulators should refrain from rushing into costly legislation ('adopting too early'),[68] which may turn out to be of little significance further down the line or even stifle innovation.[69] Market participants who wish to utilise an innovation with a view to displacing or supplementing traditional legal frameworks should be equally circumspect and keep their options open. At the same time, the peak is a necessary phase of early exploration with a view of pushing the innovation to its limits. Decision-makers should try to look beyond the superficial promises and extrapolate and realistically appreciate the wider long-term trends going beyond a particular innovation.[70] Thereby they may be better able to avoid short-term and narrow responses which may easily be bypassed later on whilst ossifying ineffectual regulatory responses.[71] Similarly, hostility and cynicism during the trough of disillusionment should be taken with a pinch of salt: in all likelihood, there will be more to an innovation than hype and disappointment; usually there is something of lasting value which just takes longer to unearth than initially expected.[72] Moreover, an innovation's capabilities and performance parameters are likely to evolve over time. An innovation may turn out to be much more useful for solving problems radically different from those for which it was initially conceived.[73] For policymakers and regulators, this requires to keep an eye on the innovation (not 'giving up too soon')[74] and to be ready to support it up the slope of enlightenment when the time comes (not 'adopting too late'),[75] also with a view to avoiding Type II errors (failing to intervene when necessary).[76] It also necessitates an exploration of an innovation's indirect consequences – for adjacent or even remote areas of law – which tend to be overlooked during the peak and trough phases.[77] Consequently, hype cycle awareness can facilitate a more effective and efficient use of legal resources: less waste of taxpayers' money for potentially futile regulatory efforts, better use of human capital and time to research and evaluate an innovation's legal potential. It also encourages an 'incremental, reflexive, and cooperative approach' to legal adjustment and accommodation[78] for both the target and displacement contexts.

67 Butenko and Larouche, n 14 above, 19, 23.
68 Fenn and Raskino, n 16 above, 51-52; Walch, n 66 above, 743.
69 De Filippi and Wright, n 8 above, 209; Werbach, n 59 above, 177.
70 Fenn and Raskino, n 16 above, 70-71.
71 Liu and others, n 15 above, 6-8.
72 Fenn and Raskino, n 16 above, 9; Werbach, n 59 above, 245 referring to 'Amara's law': 'We tend to overestimate the impact of technologies in the short run but underestimate them over the long run.'
73 Fenn and Raskino, *ibid*, 43, 79. See also Grinberg, n 50 above for an early critical assessment of Bitcoin as a 'digital currency' only, without considering blockchain technology's much wider potential.
74 Fenn and Raskino, *ibid*, 53.
75 *ibid*, 54-55.
76 Butenko and Larouche, n 14 above, 23.
77 Fenn and Raskino, n 16 above, 83.
78 Butenko and Larouche, n 14 above, 19.

PEAK OF INFLATED EXPECTATIONS – THE NEW 'LEX CRYPTOGRAPHI(C)A'?

The legal hype cycle starts when word of an innovation and excitement about its possibilities spreads beyond its developers, creating a buzz that eventually enters legal discourse. Participants – academics, law firms, regulators – that like to be ahead of the curve jump on the innovation and boast about its potential implications and transformative powers. Others start to join the bandwagon, with early critical voices being largely drowned out.[79] Blockchain technology is a case in point. Following the mining of Bitcoin's first block on 3 January 2009, it took the legal community several years to take note; in fact, only Ethereum's 'smart contract' and tokenisation capabilities really sparked the legal imagination.[80] Early enthusiasts started to highlight the technology's disruptive and/or transformative power for law and the legal system.[81] For its proponents, blockchain technology can be both an institutional technology,[82] and an innovative infrastructure. As the former, blockchain constitutes an alternative normative framework to shape human interactions.[83] As the latter, blockchain can streamline the attribution and transfer of value represented by traditional property rights.[84] When analysing the proponents' lines of reasoning in this section, it is worth keeping in mind that a certain amount of exaggeration and 'blatant showy promotion' is necessary at this stage to drive an innovation forward. To overcome the status quo inertia, proponents must overstate their case to facilitate the spreading of new ideas.[85]

Institution

By designating blockchain as an institutional innovation,[86] (early) enthusiasts could perceive the technology as an alternative to traditional law,[87] even in its

79 Fenn and Raskino, n 16 above, 8.

80 B. Carron and V. Botteron, 'How smart can a contract be?' in D. Kraus, T. Obrist and O. Hari (eds), *Blockchains, Smart Contracts, Decentralized Autonomous Organisations and the Law* (Cheltenham: Edward Elgar, 2019) 101, 104. See Grinberg, n 50 above for a critical piece that would appear to be 'pre-peak,' which did not start prior to the launch of Ethereum in 2015.

81 Seminal: A. Wright and P. De Filippi (2015), n 9 above; De Filippi and Hassan, n 51 above; Government Office for Science, *Distributed Ledger Technology: beyond block chain* (London, 2016).

82 S. Davidson, P. De Filippi and J. Potts, 'Blockchains and the economic institutions of capitalism' 2018, 2 at https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3221527.

83 D. North, Institutions, *Institutional Change and Economic Performance* (Cambridge: Cambridge University Press, 1990) 3.

84 For example P. Paech, 'Securities, intermediation and the blockchain: an inevitable choice between liquidity and legal certainty' (2016) 21 *Uniform Law Review* 612.

85 Fenn and Raskino, n 16 above, 28-29.

86 According to Douglas North, '[i]nstitutions are the rules of the game in a society.' In the absence of institutional constraints, the inherent uncertainty of self-interest impedes cooperation and impersonal exchange. In highly developed industrial and post-industrial societies, complex contracting is realised through the legal system, which allocates and monitors property rights and enforces contracts; North, n 83 above, 3, 33-35, 59.

87 Davidson, De Filippi and Potts, n 82 above, 2-3.

most basic Bitcoin iteration.[88] The concept of separate legal personality, one of the defining features of the modern business corporation, provides a pertinent example. According to Hansmann, Kraakman and Squire, separate leal personality can only be achieved through a special rule of 'organizational law', committing assets to the firm and granting priority to firm creditors.[89] The reservation of the company's assets for the company's creditors under exclusion of the shareholders' personal creditors – 'affirmative asset partitioning' or 'entity shielding' – cannot be achieved by contract[90] alone as transaction costs would be prohibitively high.[91] Blockchain does provide an alternative institutional framework for achieving 'affirmative asset partitioning' without reliance on traditional 'organizational law'. By transferring ETH to a smart contract address, investors can pool these assets for specific purposes in accordance with the coded objectives of the smart contract (or network of smart contracts). Depending on the embedded logic, neither the investors nor their personal creditors may have access to the amounts of ETH once transferred. The pooled assets can then be utilised to fund the projects that the smart contract was deployed for, perhaps on the basis of a decision-making process that relies on token holder votes. Through software-based smart contracts, parties can obtain a capital lock-in effect similar to corporate legal structures.[92] This goes beyond private market actors merely transacting freely within the confines of the general law. Rather, blockchain allows them to achieve a goal that hitherto could only be achieved with the assistance of a specific legal rule.[93]

88 The 'rules of the game' – defining and tracking value as a chain of transaction outputs (UTXOs), proof-of-work consensus on the longest chain etc – provide a new way of coordinating economic activity; *ibid*, 4.

89 H. Hansmann and R. Kraakman 'The Essential Role of Organizational Law' (2000) 110 *Yale Law Journal* 387, 422.

90 In the economic sense as 'relationships characterized by reciprocal expectations and behaviour;' O. Hart 'An Economist's Perspective on the Theory of the Firm' (1989) 89 *Columbia Law Review* 1757, 1764, note 30; M.A. Eisenberg, 'The Conception that the Corporation is a Nexus of Contracts and the Dual Nature of the Firm' (1998) 24 *Journal of Corporation* Law 819, 822-823.

91 Hansmann and Kraakman, n 89 above, 406-422; H. Hansmann, R. Kraakman and R. Squire, 'Law and the Rise of the Firm' (2006) *Harvard Law Review* 1335, 1340-1343. In order to grant a firm's creditors priority on the firm's assets by contract, every 'owner' of the firm would have to obtain from all of their personal creditors, both past and future, agreements subordinating their claims on the respective owner's assets to those of the firm's creditors. The costs of negotiating and obtaining these subordination agreements would be extremely high in most cases and would increase with the number of 'owners' of the firm; *ibid*, 1340. In addition, it would be impossible to credibly promise the firm's creditors priority on the firm's assets because compliance with the subordination requirements could not easily be monitored or bonded. Moreover, every owner of the firm has an incentive to opportunistically omit the subordination clause in agreements with his own personal creditors, as this would reduce his personal costs of credit; *ibid*.

92 Wright and De Filippi, n 9 above, 3. Perhaps the simplest operation to achieve a capital look-in would be the sending of Bitcoin UTXOs to a multisignature Bitcoin address, with the effect that the value committed to the address can only be unlocked and spend if the spending transaction is signed by the required threshold of private keys ('M-of-N multisig'): A. Antonopoulos, *Mastering Bitcoin* (O'Reilly, 2nd ed, 2017) 82.

93 Pistor (2019), n 58 above, 56.

Accordingly, for Wright and De Filippi blockchain has the 'potential to fundamentally shift the way in which society operates'.[94] Self-enforcing rules could supplant traditional laws, with people increasingly bypassing the traditional legal framework of contract law to rely on blockchain instead.[95] Citizens could 'create custom legal systems as a decentralized alternative to the current legal system – a new digital common law', capable of regulating society more efficiently' by reducing the costs of law enforcement and allowing for a system of customised rules that is more aligned with citizens' preferences.[96] For Ortolani, even the first-generation Bitcoin blockchain constitutes an 'autonomous legal order' with 'enforcement jurisdiction'.[97] For Abramowicz, Bitcoin and other cryptocurrencies can form the basis for what he calls 'peer-to-peer law', which can be defined as 'a system of decision-making generally regarded as authoritative even though it lacks a centrally designated authority to make and enforce decisions'.[98] Extending this notion, 'computational courts and juries' could resolve disputes by relying on 'the wisdom of the crowd through structured voting mechanisms implemented through smart contracts'.[99]

For enthusiasts, these possibilities require a fundamental rethinking of the role of law in society.[100] Blockchain-based systems are governed by two sets of rules: 'legal code' provided by the traditional legal system; and 'technical code,' the algorithmic rules encoded by the relevant software. Whereas legal code is 'extrinsic' so that its rules can be broken, technical code is 'intrinsic': a breach returns an error message.[101] Self-regulation through customary rules and technical standards elaborated for internal use by community members could be seen as 'a natural extension of the so-called *Lex Mercatoria*'.[102] Wright and De Filippi define this new *Lex Cryptographi(c)a* as a 'set of rules administered through self-executing smart contracts and decentralized (autonomous) organizations',[103] a body of substantive law embodied in technical code, creating 'order without law' and implementing 'what can be thought of as private regulatory frameworks'.[104] Unlikely to replace traditional law, blockchain may shift the balance

94 Wright and De Filippi, n 9 above, 2; also Davidson, De Filippi and Potts, n 82 above, 10-13; M. Raskin, 'The Law and Legality of Smart Contracts' (2017) 1 *Georgetown Law Technology Review* 305, 309.

95 De Filippi and Wright, n 8 above, 55.

96 Wright and De Filippi, n 9 above, 40-41.

97 P. Ortolani, 'Self-Enforcing Online Dispute Resolution: Lessons from Bitcoin' (2016) 36 *Oxford Journal of Legal Studies* 595, 608, 610-616.

98 M. Abramowicz, 'Cryptocurrency-Based Law' (2016) 58 *Arizona Law Review* 359, 367-369. Cryptocurrency platforms perform this function by maintaining a ledger, spending resources, and making decisions as to the longest chain.

99 Werbach, n 59 above, 215.

100 Dimitropoulos, n 59 above, 1142.

101 V. Lehdornvita and R. Ali, 'Governance and Regulation' in Government Office for Science, n 81 above, 40, 41; Werbach, n 59 above, 137: Blockchain's code as 'a different kind of law.'

102 Wright and De Filippi, n 9 above, 46.

103 Wright and De Filippi, *ibid*, 48. Wright and De Filippi's *Lex Cryptographia* manifesto has been downloaded more than 26,000 times from SSRN (https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2580664).

104 De Filippi and Wrigh, n 8 above, 5. Similarly, Reyes defines '*Cryptolaw*' as a 'disruptive legal discourse' that will emerge as a result of implementing and delivering the law of any subject matter through 'crypto-legal structures' as legal rules in the form of, and executed by, technical code. See C. Reyes, 'Conceptualizing Cryptolaw' (2017) 96 *Nebraska Law Review* 384, 399.

between law and technological architecture with a move towards alternative regulatory mechanisms based on technical code.[105] The underlying substantive rules may be derived from traditional laws and regulation prescribed by legal authorities or may be the result of self-regulation and customary standards elaborated under the threat of a government crackdown if socially acceptable rules are not adhered to.[106] Accordingly, blockchain networks will continue to operate, as a regulatory target, under the rule of law: governments retain the power to directly regulate users, network operators, miners, centralised exchanges and other intermediaries operating within their jurisdictions, and may intervene in cryptoasset markets through purchasing and maintaining cryptocurrency reserves, acquiring hash power and entering the mining game, and/or taxing various network participants.[107]

With its somewhat extravagant claims,[108] this literature, many proponents of which have a background in law and technology, internet law and internet activism,[109] exhibits clear peak characteristics. At the same time, traditional state-enforced law seems to retain its normative superiority: legal code trumps technical code. The (unspoken) reason for this (implicit) conflicts-rule seems to be rule of law concerns. For Werbach, 'law is necessary not because of limitations in technology, but limitations in people'.[110] When Schrepel and Buterin write that 'law … must remain the overriding constraint on our society',[111] it has a certain intuitive appeal for lawyers steeped in the Western legal traditions. However, when taking this notion to its logical conclusion, blockchain becomes nothing more than a private arrangement carried out within the transactional freedom afforded by general law. The notion of blockchain as an institution evaporates and the comprehensive re-conceptualisation of our notion of law would appear quite unnecessary. Moreover, the rule of law justification for the assumed normative superiority of law over blockchain code seems quite weak. Even domestically, the rule of law is far from perfect: significant parts of the law are shaped behind the closed doors of large law firms, not by public legislatures or even courts.[112] This is not too dissimilar to blockchain protocols and smart contracts being created by private actors with limited public debate and scrutiny.[113] Large portions of society are excluded from access to justice and will never have 'their day in court'.[114] Supreme courts may be more inclined to

105 Wright and De Filippi, n 9 above, 50-51.
106 *ibid*, 56-58.
107 De Filippi and Wright, n 8 above, 208.
108 Fenn and Raskino, n 16 above, 29.
109 For example https://en.wikipedia.org/wiki/Primavera_De_Filippi; https://cardozo.yu.edu/directory/aaron-wright; https://law.stanford.edu/directory/thibault-schrepel/; http://werbach.com/; https://www.birmingham.ac.uk/staff/profiles/law/yeung-karen.aspx.
110 Werbach, n 59 above, 157.
111 T. Schrepel and V. Buterin, 'Blockchain Code as Antitrust' (2021) *Berkeley Technology Law Journal* 1, 12.
112 Pistor (2019), n 58 above, 19, 133.
113 De Filippi and Hassan, n 51 above, 7.
114 K. Yeung, 'Blockchain, 'Transactional Security and the Promise of Automated Law Enforcement: The Withering of Freedom Under Law?' in iRights.Media (eds), *3TH1CS* (iRights.Media, 2017) 5-6. Most consumers, employees or tenants will be unable to enforce their legal rights in a court of law due to the sheer unaffordability of the legal process; Werbach, n 59 above,

decide along party lines than in accordance with constitutional principles,[115] and governments may be tempted to curtail the role of parliaments when it comes to fundamental decisions.[116] Systematic voter suppression and gerrymandering may further reduce the legitimacy of the domestic rule of law.[117] Importantly for a technology with potentially worldwide reach, there is no global or international rule of law. The intuitive appeal of 'law trumps code' quickly dissolves in the face of authoritarian regimes with at best murky, and at worst abysmal human rights records.[118]

Despite these inherent tensions, this peak-time literature must be credited with generating excitement about blockchain technology and inspiring a broad legal discourse concerning the technology's potential in various areas of law. In accordance with peak-time opportunities, it allows for assessing the technology in the context of wider long-term trends,[119] notably the reduced legitimacy and trust in traditional institutions, including the legal and financial systems. To fully appreciate blockchain's potential requires accepting law and blockchain as alternative and competing institutions, that each constitute self-contained normative systems.[120] As with the relationship of EU law to the constitutional orders of the Member States,[121] one normative order may seek to assert its superiority over another, which the latter may (partially) accept or reject. However, clashes cannot be resolved on a normative basis, only by brute force. Accordingly, governments may be able to shut down a blockchain network by attacking users or gatekeepers within their jurisdiction;[122] or the network may be so dispersed that not even states acting in concert can effectively limit the network's operation. The outcome is determined not normatively but by the reach of a particular government's coercive power. Normatively, the conflict can only be resolved by developing metanorms that transcend both law and blockchain. Brownsword's 'benchmarks for legitimacy' offer an attractive starting point: respect for the essential conditions for continued human social existence; respect for the reference community's fundamental values; and aspiration to achieve a reasonable balance of conflicting interests within the reference community.[123]

213: 'In many cases, the costs of dispute resolution will so far exceed the potential recovery that "quick-and-dirty" reliance on the naïve actions of machines will be sufficient.'

115 See *Bush* v *Gore* 531 US 98 (2000) 128-129 per Justice Stevens: 'Although we may never know with complete certainty the identity of the winner of this year's Presidential election, the identity of the loser is perfectly clear. It is the Nation's confidence in the judge as an impartial guardian of the rule of law.'

116 See *R (on the application of Miller)* v *The Prime Minister; Cherry and Others* v *Advocate General for Scotland* [2019] UKSC 41.

117 See *Shelby County* v *Holder* 570 US 529 (2013) 33 per Justice Ginsburg: 'Throwing out preclearance when it has worked and is continuing to work to stop discriminatory changes is like throwing away your umbrella in a rainstorm because you are not getting wet.'

118 Accordingly, blockchain's potential as an alternative institution and normative system could be particularly relevant for economies where the legal system and traditional market institutions are deficient; A. Hamadi, N. Hashal, E. Kandel and Y. Yafeh, 'Technological progress and the future of the corporation' (2018) 6 *Journal of the British Academy* 215, 225; Werbach, n 59 above, 171.

119 Fenn and Raskino, n 16 above, 71.

120 As pointed out earlier, blockchain allows participants to transact in ways that hitherto required a specific rule of law.

121 P. Craig and G. de Burca, *EU Law* (Oxford: OUP, 7th ed, 2020) ch 10.

122 Wright and De Filippi, n 9 above 51.

123 Brownsword (2021), n 48 above, 71-76.

A normative system that adheres to these principles should take precedence over one that does not or not to the same extent. Depending on the circumstances, law or blockchain may come out on top, and governance through blockchain code may be most attractive where legal and other institutions are most deficient.[124] As Werbach writes: 'Where the software code is an inherently superior mechanism, law should gradually give way.'[125]

Taking blockchain seriously as an institutional technology has a further consequence: institutional change normally occurs incrementally through marginal adjustments over time.[126] Any radical change of the formal rules – like using blockchain to replace or enhance legal ordering – will be hampered by informal constraints: customs, traditions, codes of conduct.[127] Perhaps something similar can be observed when even blockchain enthusiasts tie the technology's regulatory capacity to the mast of the traditional rule of law. It follows that widespread adoption of blockchain will happen only slowly and gradually over an extended period, if at all.[128] In other words, a particularly long trough of disillusionment should be expected.[129]

Infrastructure

During peak times, parts of the legal discourse may shift towards exploring an innovation's potential for particular legal disciplines.[130] Thus, as infrastructure, blockchain may be seen as having the capacity to enhance the efficiency and/or efficacy of traditional mechanisms in various areas of law.[131] Given Bitcoin's origin as a peer-to-peer electronic cash system and the financial system's reliance on various ledger entries across numerous financial institutions, it is not surprising that the financial sector has been widely viewed as a prime target for disruption by blockchain.[132] Legal discourse here is dominated by financial market participants and contributors with a background in commercial, financial and securities law.[133]

A prime example is DLT/blockchain's potential for upending the arcane securities settlement infrastructure, which has been extensively discussed. For about half a century, most investment securities – publicly traded shares and bonds – have been held and transferred through an immobilised and/or

124 Werbach, n 59 above, 160.
125 *ibid*, 178. Werbach's benchmark for superiority are 'generally accepted public policy goals' without specifying what these are.
126 North, n 83 above, 83.
127 *ibid*, 6.
128 *ibid*, 93.
129 Fenn and Raskino, n 16 above, 76-77.
130 *ibid*, 70.
131 Dimitropoulos, n 59 above, 1171.
132 P. Godsiff, 'Disruptive Potential' in Government Office for Science, n 81 above, 52, 60; Euroclear and Oliver Wyman, *Blockchain in Capital Markets: The Prize and the Journey* (2016); DTCC, *Embracing Disruption: Tapping the Potential of Distributed Ledgers to Improve the Post-Trade Landscape* (2016); A. Pinna and W. Ruttenberg, 'Distributed ledger technologies in securities post-trading' ECB Occasional Paper Series No 172/April 2016; Paech, n 84 above, 612.
133 See *ibid*; and for example https://www.lse.ac.uk/law/people/academic-staff/philipp-paech; https://www.stern.nyu.edu/faculty/bio/david-yermack; https://pinnaweb.wordpress.com/.

dematerialised system of intermediated securities.[134] A multi-tiered chain of intermediation leads from issuer through securities depositories, custodians, clearing members and their various clients to the ultimate account holder or end investor. Throughout, securities are held in the form of fungible pools – so-called 'omnibus accounts'.[135] Within this system, (interests in) securities are transferred by book entry only. Following the clearing process, settlement requires the adjustment (crediting and debiting) of securities accounts across the various intermediaries.[136] Records have to be reconciled across multiple ledgers.[137] The system has a tendency to severely weaken the legal position of the end investor[138] and may even threaten the integrity of the established corporate governance system.[139]

Blockchain enthusiasts have suggested that holding securities and settling trades through a blockchain-based system could address many of the ills of the current intermediated set-up.[140] In a direct holding system of cryptosecurities, clients could 'own' the cryptosecurities directly through their securities (and cash) wallets provided by their network participant.[141] Blockchain technology may 'allow votes to be quickly and securely recorded, streamlining a proxy

134 G. Morton, 'Historical Introduction: The Growth of Intermediation and Development of Legal Analysis of Intermediated Securities' in L. Gullifer and J. Payne (eds), *Intermediation and Beyond* (Oxford: Hart, 2019) 23; Paech, n 51 above, 614-619.

135 L. Gullifer and J. Payne, 'Introduction' in Gullifer and Payne (eds), *ibid* 1, 6-13.

136 Pinna and Ruttenberg, n 132 above, 19-20.

137 P. Paech, 'The Governance of Blockchain Financial Networks' (2017) 80 *Modern Law Review* 1073, 1079.

138 Most approaches for the classification and legal treatment of the end investor's entitlement provide some measure of proprietary protection, which remains vulnerable to inadequate segregation and shortfalls in the relevant securities accounts; UNIDROIT, *UNIDROIT Legislative Guide on Intermediated Securities: Implementing the Principles and Rules of the Geneva Securities Convention* (2017) 16-27; V. Dixon, 'The Legal Nature of Intermediated Securities: An Insurmountable Obstacle to legal Certainty' in Gullifer and Payne (eds), n 134 above, 47. The resulting uncertainties are amplified in the cross-border context. Crucially, the end investor can never have more rights than those granted by the most restrictive contract terms and applicable law within the chain of intermediation. See E. Micheler, 'Custody Chains and the Asset Values: Why Crypto-Securities are Worth Contemplating' (2015) 74 *Cambridge Law Journal* 505, 509-521; R. Salter, 'Enforcing Debt Securities' in Gullifer and Payne (eds), n 134, 129, 133; *Secure Capital SA* v *Credit Suisse AG* [2017] EWCA Civ 1486; *Eckerle* v *Wickeder Westfahlenstahl GmbH* [2013] EWHC (Ch) 68.

139 Vice Chancellor J Travis Laster, 'The Block Chain Plunger: Using Technology to Clean Up Proxy Plumbing and Take Back the Vote' Keynote Speech Council of Institutional Investors, Chicago, 29 September 2016, 14. In a seminal article, Kahan and Rock have analysed the various pathologies of corporate voting in the US, arising predominantly as a result of securities intermediation: M. Kahan and E. Rock, 'The Hanging Chads of Corporate Voting' (2008) 96 *Georgetown Law Journal* 1127. *In re Appraisal of Dell, Inc* 143 A. 3d 20 (Del. Ch. 2016) neatly exemplifies the complexity of the proxy voting machinery under an intermediated system. *In re Dole Food Co., Inc* No CV 8703-VCL, 2017 WL 624843 (Del. Ch. 2017) the settlement administrator received prima facie valid claims for just over 49 million shares, although according to Cede's centralised stock ledger only just under 37 million shares were actually outstanding.

140 Laster, *ibid*, 16; L. Lee, 'New Kids on the Blockchain: How Bitcoin's Technology Could Reinvent the Stock Market' (2016) 12 *Hastings Business Law Journal* 81, 82; for an early critical voice, see A. Walch, 'The Bitcoin Blockchain as Financial Market Infrastructure: A Consideration of Operational Risk' (2015) 18 *Legislation and Public Policy* 837, although the construction of financial market infrastructures for traditional assets on top of the Bitcoin blockchain seems a bit of a strawman.

141 Pinna and Ruttenberg, n 132 above, 25; Werbach, n 59 above, 166.

voting process that has historically been labour-intensive and fragmented'.[142] The transfer of securities (and cash) could take place directly between seller and buyer.[143] A transfer of shares on the blockchain could be settled much more quickly than with the current two or three day delays; the fees and commissions of the numerous intermediaries could be avoided.[144] With all network participants having access to identical copies of the ledger, there would be no need for the reconciliation of possibly conflicting records.[145]

Accordingly, for Yermack, blockchain technology has the potential to change 'corporate governance as much as any event since the 1933 and 1934 securities acts in the United States' and could potentially solve many problems associated with companies' inability to keep accurate and timely records of who owns their shares.[146] For Paech, blockchain may not only disrupt financial market structures, but also the underpinning law itself, as the current legal framework may not be able to easily cope with cryptoassets that are 'delocalized and not held and transferred through intermediaries'.[147] Accordingly, jurisdictions 'will need to redefine the entire legal framework'.[148] In this spirit, Delaware, a leader in corporate law and finance, amended its General Corporation Law (DGCL) in 2017,[149] ensuring that the use of blockchain technology does not compromise the validity of otherwise DGCL-compliant share issues or communications.[150] French law authorised the use of blockchain technology for the issuance and transfer of unlisted securities.[151]

Despite these early initiatives, blockchain technology has taken hold only at the margins of traditional finance.[152] Hype cycle dynamics are at play when Raskin observes that 'the vision of the first movers often gives way to the realities of a conservative world that looks askance at new technologies'.[153] Crucially, how quickly an innovation moves from the peak through the trough and up the slope of enlightenment depends not just on the high relative advantage compared to the status quo but also on an innovation's complexity and compatibility with the current infrastructure. The more complex an innovation and the more dependent on a completely new or revamped infrastructure, the longer it will take for it to reach the plateau of productivity, in particular where significant behavioural change amongst market participants will be necessary.

142 D. Yermack, 'Corporate Governance and Blockchains' (2015) National Bureau of Economic Research Working Paper 21802, 24.
143 Lee, n 140 above, 118, 123-125; Paech, n 137 above, 1074.
144 Pinna and Ruttenberg, n 132 above, 26.
145 A. Seretakis, 'Blockchain, Securities Markets, and Central Banking' in Hacker, Lianos, Dimitropoulos and Eich (eds), n 48 above, 212, 218; R. Gendal Brown, 'Technology' in Government Office for Science, n 81 above, 32, 36.
146 Yermack, n 142 above, 1.
147 Paech, n 84 above, 613; Paech, n 137 above, 1079.
148 Paech, n 84 above, 614.
149 DGCL §224.
150 J.T. Laster and M. Rosner, 'Distributed Stock Ledgers and Delaware Law' (2018) 73 *Business Lawyer* 319.
151 C. Van der Elst and A. Lafarre, 'Blockchain and Smart Contracting for the Shareholder Community' (2019) 20 *European Business Organization Law Review* 111, 132; Seretakis, n 145 above, 223-225.
152 See below text to footnotes 213-226.
153 Raskin, n 94 above, 309.

In this respect, blockchain appears as a 'long fuse' innovation.[154] As Mainelli and Milne have pointed out, merely sanctioning the move of securities records from a traditional database to DLT/blockchain is unlikely to result in significant efficiency gains. It only addresses a single and straightforward aspect of transactions in securities. The on-chain data will still have to be reconciled and combined with a wide range of off-chain data sources capturing various business processes, including the agreement on a trade between the parties. Established business practices may be even more sticky than the legal framework itself.[155] For DLT/blockchain to reach its full potential as securities settlement infrastructure would require a costly and lengthy reengineering of operational processes and business models across multiple financial firms.[156] Moreover, although investors may benefit, many powerful intermediaries within the current securities settlement ecosystem – custodians, clearinghouses, settlement agents – have little incentive to facilitate a transition to a DLT/blockchain-based system.[157]

For these reasons it is no surprise that blockchain has not (yet) resulted in a comprehensive transformation of traditional financial markets as envisaged by peak-time enthusiasts. Perhaps it never will. Still, peak-time literature may be credited with reinvigorating the debate about the inefficiencies of the current system, which may subsequently be addressed by alternative means.[158] In that sense, blockchain technology may 'fall off the hype cycle' (at least for this particular use case), or parts of it may become embedded in other products. Its capabilities, however, in the form of faster and cheaper payments and settlement systems, will remain significant and desirable.[159] This should be kept in mind when exploring the legal discourse during the trough.

TROUGH OF DISILLUSIONMENT – 'CLOUD CRYPTO LAND'?

When an innovation fails to deliver in the short and medium term on the promises propagated during peak times, it will enter a trough of disillusionment. Negative stories will start to appear that focus on the challenges and limitations

154 Fenn and Raskino, n 16 above, 77-78.

155 For example, traders do not normally have securities or cash readily available at the time of trade execution. Settlement is normally delayed by a few days, which, as part of the clearing process, allows for the netting and significant reduction of the volume of trades to be eventually settled. Near-real time settlement is already possible based on current technical arrangements; however, it would require the pre-trade positioning of cash and securities with significant consequences for accounting and management reporting as well as the management of exposure to liquidity risks. In short, the current delayed settlement is a design choice involving deep market structures which are not easily upended.

156 M. Mainelli and A. Milne, 'The Impact and Potential of Blockchain on the Securities Transaction Lifecycle' (2016) SWIFT Institute Working Paper No 2015-007, 22-28.

157 W. Song, 'Bullish on Blockchain: Examining Delaware's Approach to Distributed Ledger Technology in Corporate Governance Law and Beyond' (2017) 8 *Harvard Business Law Review Online* 1, 19-20.

158 One could think for example of the Faster Payments infrastructure; https://www.fasterpayments.org.uk/our-achievements.

159 Fenn and Raskino, n 16 above, 61-62.

of an innovation. Driven by the same availability and confirmation biases as during the peak, a negative sentiment may become prevalent for a while.[160] Thus, in legal discourse, we may see critical pieces in high profile publications that reinforce earlier sentiments drowned out during the peak. In this respect, the conceptual challenges mounted against blockchain can be broken down into arguments based on its technological limitations and on the lack of synchronicity between blockchain and the law. This latter argument is specifically legal and based on what Brownsword has called 'coherentism' where the integrity and consistency of existing legal doctrine matters above all else.[161] When assessing these trough-stories, it is worth keeping in mind that for any innovation to mature it needs to be used by various market participants and organisations under different conditions to test its limits and capabilities. This inevitably takes longer than people anticipate.[162] Also, innovations rarely remain static but evolve in terms of both technical specifications and performance capabilities.[163]

Technological limitations

According to the sceptics, the widely lauded decentralisation remains illusory as blockchain technology cannot replace human intermediaries.[164] The rules embedded in a blockchain will have been coded by a handful of 'core developers'[165] with enormous power.[166] The humans who write and deploy blockchain protocols face the same governance issues as traditional third-party intermediaries – rent seeking, conflicts of interests, etc.[167] The consensus algorithm can provide data authenticity and transaction security only in respect of on-chain events; off-chain events – like share price movements, or the fact of delivery of goods and services – cannot, as such, be verified by a blockchain's consensus mechanism.[168] Oracles that verify off-chain events on the basis of external data

160 *ibid*, 34-35.
161 Brownsword (2021), n 48 above, 32.
162 Fenn and Raskino, n 16 above, 38.
163 *ibid*, 79.
164 Low and Mik, n 12 above, 139.
165 *ibid*; A. Walch, 'In Code(rs) We Trust – Software Developers as Fiduciaries in Public Blockchains' in Hacker, Lianos, Dimitropoulos and Eich (eds), n 48 above, 58.
166 Roubini, n 5 above, 19; Werbach, n 59 above, 233: 'The powers of courts and regulatory agencies is easy to see; that of code and its masters, less so. Yet both are powerful regulators'; K. Thomson, 'Reflections on Trusting Trust: 1983 Turing Award Lecture' (1984) 27 *Communications of the ACM* 761, 763: 'You can't trust code that you did not totally create yourself. (Especially code from companies that employ people like me.) … No amount of source-level verification or scrutiny will protect you from using untrusted code.'; Pistor (2019), n 58 above, 185-186; Walch, n 140 above, 870.
167 Low and Mik, n 12 above, 140; V. Lehdonvirta, 'The blockchain paradox: Why distributed ledger technologies may do little to transform the economy' 5-6 at https://www.oii.ox.ac.uk/blog/the-blockchain-paradox-why-distributed-ledger-technologies-may-do-little-to-transform-the-economy/; Werbach, n 59 above, 134; Pistor (2019), *ibid*, 194; Walch, *ibid*, 872-876.
168 Low and Mik, *ibid*, 145; E. Mik, 'Smart Contracts: Terminology, Technical Limitations and Real World Complexity' (2017) 9 *Law, Innovation & Technology* [8]; E. Mik, 'Smart Contracts: A Requiem' (2019) *Journal of Contract Law* [6]-[7].

sources[169] must be trusted[170] and create a (further) source of centralisation and intermediation.[171] In addition, scaling up beyond tracking value through on-chain transaction messages does require the building of increasingly complex applications on top of a blockchain, potentially compromising decentralisation, data authenticity, transaction security and transparency.[172] And coding errors are inevitable, and their occurrence significantly increases with the complexity of the smart contract architecture.[173]

These concerns are neatly captured by what Vitalik Buterin has described as blockchain's 'scalability trilemma':[174] it will be hard in any blockchain system to simultaneously maximise scalability, decentralisation and security; inevitably sacrifices will have to be made in respect of at least one of these attributes.[175] For the sceptics, this renders blockchain either useless or pointless in any business setting that references off-chain assets: an open permissionless blockchain lacks scalability (at the protocol layer) and requires enormous trust to be placed in unknown developers who are subject to conflicts of interests and face all the governance problems associated with central intermediaries. The only feasible application is a private database maintained and replicated across a number of devices ultimately controlled by a single entity.[176] Here, blockchain is pointless: mutually trusting parties can simply incorporate a jointly owned subsidiary to maintain the central database, subject to consensus rules for state updates.[177]

To the extent that it is based on un-reflected peak-time exaggerations – decentralisation, security, automation and scalability to be simultaneously desirable in all circumstances – the 'scalability trilemma' critique is weak. What realistically matters for technologists and what lies behind the hype are solutions that are 'good enough' for solving the problem at hand. This entails trade-offs: between censorship resistance and resource efficiency, between data integrity and processing speed, between node democracy and hackability, and more.[178] (De)centralisation is a matter of degree,[179] and security and trust are

169 Low and Mik, *ibid*, 172.
170 Schuster, n 11 above, 26.
171 Mik (2017), n 168 above, [23].
172 *ibid*, [9].
173 Low and Mik, n 12 above, 172-173; Walch, n 140 above, 856.
174 Roubini, n 5 above, 10-20.
175 For example, a highly decentralised system can provide maximum security through an elaborate proof-of-work consensus mechanism. However, verification and storage of every single transaction by every participating node in combination with a 'work-intensive' consensus algorithm limits both the number and complexity of transactions that can be processed. Bitcoin has never been hacked but can process only seven transactions per second (as compared to Visa's 1,700 or even 65,000 on full capacity). Additional software layers operating on top of blockchain platforms (for Bitcoin: https://cointelegraph.com/lightning-network-101/what-is-lightning-network-and-how-it-works; for Ethereum: https://www.theblockcrypto.com/post/10793/understanding-plasma-part-1-the-basics) may allow for enhanced transactions throughput. However, these technologies provide an additional target for hackers and are much more vulnerable than the base protocols.
176 Roubini, n 5 above, 29-35.
177 Schuster, n 11 above, 20.
178 Cambridge Report, n 2 above, 45-46; Werbach, n 59 above, 244.
179 A. Narayanan, J. Bonneau, E. Fleten, A. Miller and S. Goldfeder, *Bitcoin and Cryptocurrency Technologies* (Princeton, NJ: Princeton University Press, 2016) 28.

equally non-binary concepts.[180] Decentralisation is not an end in itself; it is a means for market participants to retain the optimum level of independence from centralised economic power.[181] The point of blockchain technology is not replacing a central database with a centralised master ledger feeding into a shared database. Rather, it is replacing multiple centralised databases that need to be reconciled with equally authoritative distributed ledgers that are synchronised automatically.[182] What blockchain can achieve is the decentralisation and automation of certain aspects of compliance and rule enforcement, which may be extremely useful even though at the metalevel of rule creation traditional governance issues may arise and need to be resolved by traditional means off-chain.[183]

'Synchronicity' issues

From a hype cycle perspective, the 'lack of synchronicity argument' is essentially a long-fuse argument[184] taken to the extreme: blockchain technology is highly incompatible with the current legal environment and its actual or perceived benefits not strong enough to force the necessary legal change to accommodate the technology. Thus, on the premise of law as the ultimate arbiter of the allocation of property rights, the argument boils down to the blockchain ledger either being permanently out of sync with the law, rendering blockchain useless as a system for the tracking and transfer of property rights; or compromising blockchain's most attractive features – decentralisation, tamper-resistance, 'immutability' – by trying to ensure synchronicity, rendering its deployment pointless.[185]

For example, for a transfer of value in Bitcoin the sender of a transaction message references a previously unspent transaction output (UTXO), provides his private-key-derived digital signature as spending condition, and addresses a newly created UTXO to the recipient, who can then subsequently spend this new UTXO. However, what if the sender was incapacitated when she hit the send button in her wallet? What if the transfer was induced by fraud or duress, or the wallet had been stolen?[186] Numerous restrictions may compromise the validity and enforceability of transactions,[187] ranging from broad concepts like fraud to more specific limitations like a *numerus clausus* of property rights.[188] For traditional assets – real and personal property – transactions that come in conflict with these restrictions may be void or voidable, depending on the legal system, the asset class and type of limitation at issue. Given that the blockchain

180 Werbach, n 59 above, 102. The same goes for 'immutability', see Walch, n 66 above, 735-745.
181 Schrepel and Buterin, n 111 above, 8.
182 Werbach, n 59 above 96: 'Participants in Symbiont's syndicated loan trial or Walmart's food-safety pilot trust the ledger more and each other less than they would in the traditional arrangements.'
183 Werbach, *ibid*, 134.
184 Fenn and Raskino, n 16 above, 77-78.
185 Schuster, n 11 above, 14-20.
186 *ibid*, 14-16; Low and Mik, n 12 above, 142; Werbach, n 59 above, 180-182.
187 Schuster, *ibid*, 15.
188 Low and Mik, n 12 above, 151.

execution environment is insensitive to off-chain events, the recording of a transaction as having occurred on the ledger is no guarantee of the transaction's legal validity.[189] The universally accepted single version of the truth would no longer be reliable.[190]

Sceptics argue that this lack of synchronicity cannot be easily remedied. Currently, it is not possible to embed the multitude of legal limitations in the blockchain protocol itself. Many of the relevant key concepts are open textured, subject to interpretation and reliant on the exercise of discretion,[191] based on the relevant off-chain facts.[192] A 'government backdoor', allowing courts or other authorities to directly adjust the ledger,[193] would result in an inefficient solution where a centralised database maintained by the government would do a much better job.[194] In permissioned blockchains where multiple nodes may enjoy independent editing rights to ensure synchronicity of the ledger, a 'cybersecurity nightmare' would ensue with multiple sources of failure.[195]

As a long-fuse argument, the synchronicity problem seems to be vastly overstated. Even the current legal environment seems to be much more accommodating. In Bitcoin it is possible to effectuate a 're-transfer' of value by way of a new transaction that creates a new UTXO spendable by the previous sender. A court order could be issued against the initial recipient and enforced through contempt proceedings if need be. The individual defendant may have absconded to escape the reach of domestic law,[196] but the same can happen with virtually any other movable asset, in particular cash.[197] For permissioned blockchains, in which the node operators are known and trusted with reputations at stake, the initiation of a 're-transfer' through court order would seem straightforward. Where the consensus mechanism is BFT, the 'multiple sources of failure' problem does not arise,[198] and all honest nodes have an incentive to cooperate so as to maintain the integrity of their blockchain and their reputations.

To preserve the integrity of the ledger and to treat it as a correct representation of the attribution of value, the legal environment does require a certain amount of adaptation. In this respect it is worth keeping in mind that traditional title registration systems are rarely absolute.[199] Thus even under current law, as a first step, a blockchain entry could be recognised as an evidentiary presumption of legal title in the recorded item, similar to the presumption that possession is evidence of title. This presumption could be rebutted by demonstrating the

189 *ibid*, 142.
190 Schuster, n 11 above, 16.
191 *ibid*, 15.
192 Low and Mik, n 12 above, 142, 145.
193 For example Dimitropoulos, n 59 above, 1190.
194 Schuster, n 11 above, 17.
195 Low and Mik, n 12 above, 158.
196 *ibid*, 150.
197 K. Rogoff, *The Curse of Cash* (Princeton, NJ: Princeton University Press, 2016) 41.
198 n 55 above.
199 For example, the German land register enjoys strong public faith (BGB, §892) and a disposal of proprietary interests in real property becomes effective only upon registration (BGB, §873). Still, off-register transactions and events may render the recorded property rights out of sync with the actual legal position, for example, where a mortgagor has repaid the secured debt to the effect that the mortgage does no longer belong to the registered mortgagee. In these situations, a claim arises in the person of the true rights holder to have the register rectified (BGB, §894).

transactional invalidity caused by legal rules extraneous to the cryptographically valid on-chain transaction.[200] Where tokens reference off-chain assets, a statutory intervention will be required to confer on the blockchain record constitutive effect. The problematic scenarios – fraud, duress, theft, ultra vires transactions, etc – could be addressed on the basis of restitutionary claims for the retransfer of value and/or compensation.[201] Depending on the legal system, these remedies may or may not offer proprietary protection in the defendant's insolvency.[202] To provide a sound legal footing for the operation of blockchain asset ledgers, the legal system will have to accommodate the new technology through legislation[203] and case law.[204]

Taking the long fuse narrative to the extreme, it has been argued that the law is unlikely to endorse blockchain technology and cryptoassets in the same way that negotiable instruments were gradually (and partially) endorsed as part of the *lex mercatoria* across the legal systems of Europe.[205] For 16th and 17th century merchants, the legal recognition and endorsement of negotiable instruments was vital for carrying out transactions over long distances.[206] This, it is argued, is different for blockchain technology and cryptoassets today because improving the operation of legacy systems – for payments and securities settlement, for example – may turn out to be a much more efficient alternative.[207] In other words, blockchain technology's value proposition is not strong enough to engender the necessary compatibility adjustment within the legal environment. On that basis, blockchain will fall off the hype cycle before it reaches the plateau of productivity.[208]

This line of reasoning risks falling into the 'giving up too soon' trap.[209] To start with, it appears to be somewhat circular: blockchain is useless for lack of synchronicity, and legal recognition will not be forthcoming because the technology is useless. Secondly, it underestimates the legal system's capacity for accommodating technological innovation. Historically, it seems that the legal endorsement of business practices does not generally require an overwhelming business case.[210] Market participants face a trade-off: for some parties and for some purposes improved legacy systems may be the most cost-effective options;

200 D. Fox, 'Cryptocurrencies in the Common Law of Property' in D. Fox and S. Green (eds), *Cryptocurrencies in Public and Private Law* (Oxford: OUP, 2019) 139, 157; D. Carr, 'Cryptocurrencies as Property in Civilian and Mixed Legal Systems' in Fox and Green (eds), *ibid*, 194.

201 Fox, *ibid*, 174-175. Indeed, a tendency to this effect is already visible in recent cases: *AA* v *Persons Unknown* [2019] EWHC 3556 (Comm); *Fetch.IA* v *Persons Unknown* [2021] EWHC 2254 (Comm) (proprietary injunctions in respect of fraudulently extracted cryptoassets).

202 K. Van Zwieten, *Goode on Principles of Corporate Insolvency Law* (London: Sweet & Maxwell, 5th student ed, 2019) 727-728. Across jurisdictions and over time, whether a defect renders a transaction void or voidable and the ensuing remedy proprietary or not, seems to have been largely a matter of historical accident. Protecting the integrity of the ledger is as good as any a justification for referring the claimant to merely personal remedies.

203 On the recent reforms of Liechtenstein and Swiss law, see below.

204 Paech, n 137 above, 1100; Low and Mik, n 12 above, 150.

205 Schuster, n 11 above, 20-23; but see Pistor (2019), n 58 above, 90.

206 Schuster, *ibid*, 21.

207 *ibid*, 22-23.

208 Fenn and Raskino, n 16 above, 81-82.

209 *ibid*, 53-54.

210 For example the 'industrial revolution' in England in the late eighteenth and early nineteenth century did not require general incorporation under limited liability; entrepreneurs did not lobby

for others a blockchain-based system, exploiting various design alternatives, may be more appropriate, even when considering switching costs. It is unlikely that legislatures and courts will shy away from providing a sound legal footing if there are good commercial reasons for doing so. Finally, and addressing this latter point, the innovation itself is likely to evolve when moving along the hype cycle and going through the necessary process of socialisation, adaptation and adoption. New capabilities may emerge with improved performance parameters and enhanced value propositions.[211] Arguably, this can already be observed with blockchain approaching the slope of enlightenment.

SLOPE OF ENLIGHTENMENT – CONSTANT INNOVATION AND REGULATORY CONSOLIDATION

The transition from the trough of disillusionment to the slope of enlightenment is subtle and normally less pronounced than the dramatic swings of the earlier stages. Key indicators that an innovation approaches the slope are a proliferation of new success stories, often with a focus on maturing capabilities and performance parameters. Sometimes new product versions may launch an innovation out of the trough, generating renewed excitement that can look like another peak of inflated expectations. At the same time, there will be a focus on how to harness and adopt the innovation.[212] These indicators can be observed within the legal discourse on blockchain technology. Traditional financial market players continue to successfully experiment with DLT/blockchain-based solutions across various market segments, also with a view to launching new products. As a new value proposition, Decentralised Finance (DeFi) offers the replication of financial products in a blockchain-based parallel universe. Against this backdrop, various jurisdictions have begun to promulgate ambitious legal and regulatory frameworks to accommodate cryptoassets and facilitate their more widespread adoption.

Centralised (traditional) finance

As blockchain technology continues to attract significant amounts of investment,[213] an ever-increasing number of successful pilots has demonstrated the technology's long-term potential across various sectors, ranging from lending and trade finance to securities markets and market infrastructures and

for it and were generally content with ordinary partnerships; P. Ireland, 'Limited Liability, Rights of Control and the Problem of Corporate Irresponsibility' (2010) 34 *Cambridge Journal of Economics* 837, 840–841. Moreover, see the Law Commission, *Digital Assets: electronic trade documents, A consultation paper* Consultation Paper 254 (30 April 2021) with its Draft Bill for the recognition of (DLT-based) Electronic Trade Documents (including bills of exchange, promissory notes, bills of lading).

211 Fenn and Raskino, n 16 above, 38, 79.

212 *ibid*, 82–83.

213 Forecasts suggest that spending will continue to grow and reach nearly $16 billion annually by 2023; https://www.statista.com/statistics/800426/worldwide-blockchain-solutions-spending/.

money supply.[214] For example, the Spanish bank BBVA has negotiated and signed the first blockchain-based syndicated loan.[215] Royal Bank of Scotland, Barclays and NatWest are involved in a consortium working on a 'decentralized home buying network' including 'blockchain' mortgages.[216] Santander has issued the first tokenised bond on Ethereum, with proceeds and coupon payments also tokenised, so that the bond's entire lifecycle takes place on-chain.[217] Standard Chartered PLC successfully executed a pilot of the first blockchain-based cross-border Letter of Credit, involving the transfer of an oil product from Thailand to Singapore, significantly reducing processing time and processing cost.[218] The underlying technology is now available for full commercial use.[219]

The Australian Stock Exchange (ASX) is in the process of replacing its existing clearing and settlement system with a solution based on an optional decentralised private ledger that digitally records and verifies all transactions, distributed over a global network of computers.[220] The Swiss Stock Exchange's (SIX) digital exchange (SDX) is meant to run on digital assets and digital cash. SDX's member banks will be able to settle their trades and other obligations against tokenised fiat currency (for example CHF), with both legs of a transaction (delivery and payment) occurring simultaneously.[221] Deutsche Börse Group and Deutsche Bundesbank have carried out extensive concept studies on collateral management,[222] demonstrating the potential to greatly improve collateral mobility and unlock efficiency gains as cost- and time-intensive reconciliation processes become obsolete.[223] In a strategic partnership, HQLA^{x} and Deutsche Börse Group have launched a jointly developed DLT solution for frictionless collateral swaps in the securities lending market. Commerzbank,

214 JP Morgan, *JP Morgan Perspectives: Blockchain, digital currency and cryptocurrency: Moving into the mainstream?* 21 February 2020, 15-19.

215 https://www.bbva.com/en/bbva-signs-world-first-blockchain-based-syndicated-loan-arrangement-with-red-electrica-corporacion/. Finastra's Fusion LenderComm is another DLT-based solution for syndicated lending supported by numerous banks, including BNY Mellon, HSBC, ING and State Street; https://www.finastra.com/solutions/lending/syndicated-lending/fusion-lendercomm.

216 https://www.financialreporter.co.uk/mortgages/natwest-led-consortium-launches-mobile-banking-mortgage-proposition.html.

217 https://www.santander.com/en/press-room/press-releases/santander-launches-the-first-end-to-end-blockchain-bond%C2%A0. Blockchain-based bonds have also been issued by the Bank of China (https://www.ledgerinsights.com/bank-of-china-blockchain-bond-issuance/), by the World Bank (https://www.worldbank.org/en/news/press-release/2019/08/16/world-bank-issues-second-tranche-of-blockchain-bond-via-bond-i), and the European Investment Bank (https://www.theblockcrypto.com/linked/103151/european-investment-bank-bond-public-blockchain?utm_source=coinbase&utm_medium=rss).

218 https://www.sc.com/en/media/press-release/weve-completed-our-first-cross-border-letter-of-credit-blockchain-transaction-in-the-oil-industry-with-ptt-group/.

219 https://www.contour.network/network. The Law Commission's forthcoming Electronic Trade Documents Bill will provide a firm statutory footing, Law Commission, n 210 above.

220 Only known, licensed participants will be authorised to access the system; https://www.asx.com.au/services/technology-solution.htm. The ASX implementation does not involve consensus between nodes; it is merely a shared, replicated ledger.

221 https://www.sdx.com/en/home/sdx/business-model.html.

222 Deutsche Bundesbank and Deutsche Börse Group, *How Can Collateral Management Benefit from DLT?: Project 'BLOCKBASTER'* (January 2020); *BLOCKBASTER Final Report* (2019).

223 Deutsche Bundesbank and Deutsche Börse Group (2020), *ibid*, 16-17.

Credit Suisse and UBS executed the first live trades on this platform in November 2019.[224] A consortium of major financial institutions – including Banco Santander, BNY Mellon, Barclays, Commerzbank, Credit Suisse, ING, Lloyds Banking Group, Nasdaq, UBS – has established Fnality International with a view to creating a network of decentralised financial market infrastructures 'to deliver the means of payment-on-chain in tomorrow's wholesale banking market'.[225] The expectation is that Fnality will obtain approval by one central bank in the course of 2022 and will then go live.[226]

By far the most prominent project of recent years – an example of BigTech invading the traditional (centralised) finance space – has been Facebook's (now Meta) (global) stablecoin initiative, initially called *Libra*, then *Diem* after a 2020 rebranding exercise. Stablecoins can be thought of as tokens that rely on a range of different stabilisation mechanisms to minimise price fluctuations against certain reference currencies or commodities.[227] Given Facebook's global reach and massive user base, the proposal[228] had regulators immediately up in arms.[229] In

224 https://www.hqla-x.com/.

225 https://www.fnality.org/about-fnality. Fnality intends to establish local independent decentralised Financial Market Infrastructures (dFMIs) in each currency (initially CAD, EUR, GBP, JPY and USD), each of which will operate a private, permissioned chain as part of a Fnality Payments System powered by a digital settlement asset – Utility Settlement Coin (USC). Together these will comprise Fnality Global Payments (FGP).

226 https://www.fnality.org/what-we-do#faq.

227 D. Bullmann, J. Klemm and A. Pinna, 'In search of stability in crypto-assets: are stablecoins the solution?' (2019) ECB Occasional Paper Series No 230 (August 2019) 10. Most stablecoins are issued as ERC-20 compliant Ethereum tokens (https://cryptoslate.com/cryptos/stablecoin/) and are commonly classified in accordance with the relevant stabilisation mechanism as off-chain collateralised, on-chain collateralised or algorithmic (uncollateralised); F. Schär, 'Decentralized Finance: On Blockchain- and Smart Contract-based Financial Markets' (May 2020) 1 at https://ssrn.com/abstract=3571335 6; C. Harvey, A. Ramachandran and J. Santoro, 'DeFi and the Future of Finance' December 2020, 13 at https://ssrn.com/abstract=3711777 12. Off-chain collateral may take the form of a fiat currency or a basket of fiat currencies and/or other financial assets, held off-chain by custodians in the form of deposits or intermediated securities. These tokens represent a claim on the issuer backed by the collateral (Bullmann, Klemm and Pinna, *ibid*, 12) as representations of traditional assets in form of electronic money or shares in investment funds; G7 Working Group on Stablecoins, *Investigating the impact of stablecoins* (October 2019), Annex A. On-chain collateralised stablecoins are backed by cryptocurrency units on-chain. As a consequence, issuance, redemption and margining can be handled entirely by a network of interacting smart contracts as an autonomous decentralised organisation (DAO); Bullmann, Klemm and Pinna, *ibid*, 20-26. Currently at an experimental stage, algorithmic stablecoins rely on smart contract technology to automatically adjust the supply of tokens so as to maintain parity with the price of the reference currency, amounting to an 'algorithmic central bank' with its own 'algorithmic monetary policy; *ibid*, 26-29, 43.

228 The 2019 Libra proposal envisaged Libra as an off-chain collateralized stablecoin, backed by a reserve in form of a basket of fiat currencies and sovereign debt securities held by geographically diverse custodians (https://libra.org/en-US/about-currency-reserve/#the_reserve). The *Libra* reserve would be managed by an Association which would also act as issuer of the currency token, 'minting' and redeeming ('burning') *Libra* according to supply and demand. *Libra* transactions would be verified in blocks on a permissioned blockchain with the founding members of the *Libra* Association acting as validating nodes based on proof-of-authority, eventually transitioning to a permission-less network with proof-of-stake (https://developers.libra.org/docs/assets/papers/the-libra-blockchain/2019-09-26.pdf).

229 United States House of Representatives Committee on Financial Services, Letter to Mark Zuckerberg et al of 2 July 2019 at https://financialservices.house.gov/uploadedfiles/07.02.2019_-_fb_ltr.pdf.

April 2020, the *Libra* Association issued a revised and watered down Whitepaper v2.0,[230] offering an enhanced compliance framework.[231] As of January 2022, Meta seems to have given up on the project, with the underlying technology being sold to Silvergate Bank.[232]

The prospect of a widely used privately issued global stablecoin has triggered significant interest in central bank digital currencies (CBDC).[233] Numerous central banks around the world[234] have started to contemplate or experiment with the introduction of a CBDC as a third category of base money, in addition to cash and reserves.[235] A token-based[236] CBDC as a fiat cryptocurrency could replicate some of the features of a cash payment based on a permissioned DLT network maintained by the central bank.[237] However, whether CBDC may be implemented as a fiat cryptocurrency remains to be seen.[238]

These stories demonstrate the viability of the technology in various iterations and scenarios. As permissioned networks, these traditional finance initiatives remain largely centralised and closed, relying on continued intermediation with significant opportunities for rent seeking. As such, they are at risk of being outpaced by 'decentralised finance' or DeFi, which has captured the imagination of tech and finance communities alike, resulting in a new (mini-)peak of inflated expectations just when blockchain technology approaches the slope of enlightenment.

Decentralised finance (DeFi)

As Schär explains, DeFi 'is based on open protocols and decentralised applications (DApps). Agreements are enforced with smart contracts, transactions

230 https://www.diem.com/en-us/.

231 By offering single-currency stablecoins (in addition to a multi-currency coin) and forgoing the future transitioning to a permission-less network; see also the FSB's recommendations for effective regulation of global stablecoins; Financial Stability Board (FSB), *Addressing the regulatory, supervisory and oversight challenges raised by 'global stablecoin' arrangements – Consultative Document* 14 April 2020 at https://www.fsb.org/wp-content/uploads/P140420-1.pdf (last accessed 2 December 2020) 24-33.

232 J. Fontanella-Khan, H. Murphy and M. Kruppa, 'Facebook gives up on crypto ambitions with Diem asset sale,' *Financial Times* 27 January 2022.

233 S. Fiedler, K.-J. Gern and U. Stolzenburg, 'The Impact of Digitalisation on the Monetary System' in European Parliament, *The Future of Money – Compilation of Papers, Study requested by the ECON committee* (December 2019) 6, 10; T. Mancini-Griffoli, M. Soledad Martinez Peria, I. Agur, A. Ari, J. Kiff, A. Popescu, 'Casting Light on Central Bank Digital Currency' (2018) IMF Staff Discussion Note SDN/18/08 (November 2018) 6.

234 See the Atlantic Council CBDC Tracker at https://www.atlanticcouncil.org/blogs/econographics/the-rise-of-central-bank-digital-currencies/.

235 Fiedler et al, n 233 above, 17; Mancini-Griffoli et al, n 233 above, 7.

236 A CBDC may be either account-based or token-based. The former would largely resemble the current system of deposits at commercial banks, except that accounts would be held directly with the central bank; Fiedler et al, *ibid*, 18; Mancini-Griffoli et al, *ibid*, 8.

237 Fiedler et al, *ibid*, 18; Mancini-Griffoli et al, *ibid*, 9.

238 E. Gerba and M. Rubio, 'Virtual Money: How much do Cryptocurrencies Alter the Fundamental Functions of Money' in European Parliament, n 233 above 31, 55. For example the most advanced CBDC, China's digital yuan, does not rely on DLT/blockchain; A. John, 'Explainer: How does China's digital yuan work?' 19 October 2020 at https://www.reuters.com/article/us-china-currency-digital-explainer-idUSKBN27411T.

executed in a secure and deterministic way and legitimate state changes persisted on a public Blockchain,' thereby 'creating an immutable and highly interoperable financial system with unprecedented transparency, equal access rights and little need for custodians, central clearing houses or escrow services'.[239]

The core function of the traditional financial system is to facilitate the allocation and deployment of capital across time and space, by channelling resources to investments, followed by a return via profits and interest payments.[240] Through increasingly sophisticated smart contracts, predominantly running on Ethereum,[241] the DeFi community has been able to replicate this function to some extent. Key DeFi primitives exhibit a common pattern: supported cryptoassets – ETH and a range of other Ethereum tokens[242] – can be sent to, and deposited at, smart contracts in the form of single asset 'money markets'[243] or 'liquidity pools' of asset pairs.[244] Depending on the dApp, the sender may earn an algorithmically derived variable interest rate, based on supply and demand,[245] on their deposit which can be withdrawn at any time; the deposit may serve as loan collateral[246] allowing the user to borrow, with variable interest, an alternative cryptoasset, or to mint an on-chain collateralised stablecoin in form of an interest-bearing loan token[247] with no fixed maturity.[248] Liquidity pools of asset pairs serve as automated market makers (AMMs), a form of decentralised exchange (DEX), continuously quoting a price for buying and selling each asset.[249] Whereas liquidity pools do not rely on external price feeds, these are essential for derivatives platforms that reference assets outside a liquidity

239 Schär, n 227 abive, 1; dApps are software applications that operate on a decentralised blockchain platform with smart contract capability; Harvey, Ramachandran and Santoro, n 227 above 13; see further The Wharton Blockchain and Digital Asset Project, in collaboration with the World Economic Forum, *DeFi Beyond the Hype: The Emerging World of Decentralized Finance* (May 2021).

240 R. Merton, 'The Financial System and Economic Performance' (1990) *Journal of Financial Research* 263.

241 Harvey, Ramachadran and Santoro, n 227 above, 8-9; Schär, n 227 above, 5.

242 On Ethereum, any developer can issue tokens by deploying a smart contract to that effect. Tokens are blockchain-based abstractions that represent value and can be 'owned' and 'transferred;' Antonopoulos and Wood, n 54 above, 221. Tokens may be classified in various ways: 'equity tokens' may represent 'ownership' of an underlying asset or cashflow; 'utility tokens' may give access to a certain platform functionality; 'governance tokens' may allow the holder to participate in platform decision making; Harvey, Ramachadran and Santoro, *ibid*, 15-18.

243 R. Leshner and G. Hayes, 'Compound: The Money Market Protocol' February 2019, 2-3 at https://compound.finance/documents/Compound.Whitepaper.pdf.

244 Schär, n 227 above, 9.

245 Leshner and Hayes, n 243 above, 2-3.

246 AAVE offers non-collateralised 'flash loans'. Essentially only available to developers, a flash loan requires the building of a smart contract that can borrow any available amount of supported assets without any collateral, provided this liquidity plus interest is returned to the protocol within the same transaction. If not, the smart contract will not execute and the whole transaction will be reversed; see https://aave.com/flash-loans.

247 The MakerDAO's USD pegged on-chain collateralised stablecoin DAI is a key component of the DeFi ecosystem and can be integrated with many DeFi applications: Harvey, Ramachadran and Santoro, n 227 above, 39.

248 To the extent that these loans become undercollateralised – because of the accrual of interest over time or because of a drop in the value of the collateral – arbitrageurs are incentivised to 'liquidate' the loan. See Leshner and Hayes, n 243 above, 4; Harvey, Ramachadran and Santoro, *ibid*, 36.

249 Schär, n 227 above, 9-10. The exchange rate is calculated dynamically in accordance with variations of the constant product model: where x and y represent the pool's token reserves, the

pool.[250] To provide the necessary off-chain data, Schelling-point[251] oracles rely on the holders of tokens to vote on the outcome of an event or report the price of an asset. They are incentivised to report correctly through the reputation of the platform and the value of their tokens.[252]

In this constantly evolving and expanding DeFi ecosystem,[253] credit transformation[254] is achieved by the pooling of assets and a 'liquidity incentive structure',[255] both enhancing credit quality as compared to peer-to-peer lending. Collateral assets that can be withdrawn at any moment to support loans of non-fixed maturity, and tokens can be traded and used as collateral in other applications (maturity and liquidity transformation).[256] Stablecoins, redeemable at par in fiat currency, provide a link to the traditional financial system. Importantly, within the DeFi ecosystem there is a strong tendency for decentralised governance. Starting out with centralised developer admin governance systems,[257] various applications have moved towards community governance with governance tokens, used to vote on protocol updates and the adjustment of certain parameters.[258] For now DeFi remains a niche market.[259] This 'open, transparent and more inclusive financial system'[260] is currently reserved for developers and crypto arbitrageurs;[261] openness and transparency can be

constant product model entails the constant k being the product of x and y (k=xy); it follows that any change in x necessitates a corresponding change in y (in the opposite direction) in order to keep k constant. Thus, to buy and withdraw x a trader has to supply a sufficient amount of y (at the dynamically calculated exchange rate) to keep k constant. Liquidity providers are rewarded by pool share tokens that allows them to participate in the value accumulation of a growing liquidity pool. Router contracts determine the most efficient path for swapping assets if no direct pairing exists, facilitating the trading of effectively any two tokens. See Harvey, Ramachadran and Santoro, *ibid*, 51.

250 Harvey, Ramachadran and Santoro, *ibid*, 70; Schär, *ibid*, 19. For example, dYdX offers a BTC perpetual futures contract (without a settlement date). Synthetix allows for the creation of synthetic derivative tokens whose prices may be pegged to cryptocurrencies, fiat currencies, gold or real-world equities. See Harvey, Ramachadran and Santoro, *ibid*, 59-64.

251 Abramowicz, n 98 above, 363.

252 R. Leonhard, 'Decentralized Finance on the Ethereum Blockchain' March 2019, 16-17 at https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3359732. Some platforms rely on application-specific oracle services, which may take the form of decentralised oracle networks of data providers. See Harvey, Ramachadran and Santoro, n 227 above, 70-71; Schär, n 227 above, 19.

253 See for example the list of DeFi applications at https://defipulse.com/defi-list/.

254 Z. Pozsar, T. Adrian, A. Ashcraft and H. Boesky, 'Shadow Banking' Federal Reserve Bank of New York, Staff Report No 458 (July 2010) 3.

255 This encourages suppliers to replenish/not withdraw the asset when demand is high through an ever-increasing interest rate, which also discourages borrowing of the asset during these times: Leshner and Hayes, n 238 above, 5.

256 Harvey, Ramachadran and Santoro, n 227 above, 43.

257 Leshner and Hayes, n 243 above, 8.

258 Harvey, Ramachadran and Santoro, n 227 above, 44-45.

259 Schär, n 227 above, 2. In January 2021 the total market capitalisation of all DeFi tokens had reached $45 billion, up from $2 billion in 2020. This is still only 4.6 per cent of the total crypto market of $1 trillion; L. Frost, 'DeFi Market Cap reaches $45 Billion as Token Shoot Up' 25 January 2021 at https://decrypt.co/55272/defi-market-cap-reaches-45-billion-as-token-prices-shoot-up?&utm_medium=referral&utm_campaign=feed&utm_source=coinbase.

260 Schär, *ibid*, 1; Harvey, Ramachadran and Santoro, n 227 above, 29-34; Y. Chen and C. Bellavitis, 'Decentralized Finance: Blockchain technology and the Quest for an Open Financial System' July 2019, 5 at https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3418557.

261 Wharton Blockchain and Digital Asset Project, n 240 above, 8.

elusive.[262] However, protocols such as COMPOUND, AAVE and UNISWAP demonstrate the increasing sophistication and robustness of smart contracts, which can provide stable liquidity pools with dynamically and algorithmically adjusted relative prices and interest rates. This demonstrates the maturing capabilities of blockchain technology and smart contracts, as well as new value propositions that go significantly beyond Bitcoin's initially rather modest ambition.

Legal and regulatory consolidation

Regulators and law makers are key participants in the legal discourse with a potentially major impact on hype cycle dynamics. Indeed, by excessively regulating or even banning an innovation they may plunge it into the trough or push it off the hype cycle altogether. On the other hand, regulatory interventions may help to launch an innovation out of the trough and up the slope of enlightenment. The legal discourse on blockchain technology may be approaching this stage.

Early regulatory ventures into the cryptocurrency space were limited in scope and ambition.[263] The SEC approached cryptoassets by tentatively extending existing securities regulation to all sorts of tokens on the basis of a case-by-case analysis.[264] Other regulators provided a 'safe space' for innovative businesses[265] in the form of 'innovation hubs' and 'regulatory sandboxes'.[266] At the opposite end of the spectrum were the outright bans of ICOs in China and South Korea.[267] In aggregate, this may be characterised as a regulatory wait-and-see approach, to curb the most egregious excesses whilst enabling the most promising innovations.[268] As long as cryptoasset markets remain niche, this approach is rational, given that any regulatory intervention is only justified where

262 An investor may stake ETH in the MakerDAO to obtain DAI stablecoins, which may then be lend to a COMPOUND token pool in exchange for cDAI, used to increase the UNISWAP ETH/cDAI liquidity pool in exchange for UNI-cDAI tokens representing the share in the liquidity pool, which may then be used on other platforms. Leaving aside the eery resemblance of the infamous CDO^2 and CDO^3 securitisation transactions in the run up to the Global Financial Crisis, the piling of token upon token increases the risk that bugs in any of the smart contracts will bring down the entire structure. See Schär, n 227 above, 19.

263 For example, New York's early BitLicense regulation. See N.Y. Comp. Codes R. & Regs tit. 23 § 200 (2020); D. Chu, 'Broker-Dealers for Virtual Currencies: Regulating Cryptocurrency Wallets and Exchanges' (2018) 118 *Columbia Law Review* 2323, 2342-2343; Dimitropoulos, n 59 above, 1149.

264 Securities and Exchange Commission (SEC), *Report of Investigation Pursuant to Section 21(a) of the Securities Exchange Act of 1934: The DAO* Release No 81207 (25 July 2017); *SEC* v *Recoin Group Foundation, LLC* Complaint, 29 September 2017; *SEC* v *AriseBank et al* Complaint, 25 January 2018; *SEC, In the Matter of Munchee, Inc* Order, 11 December 2017.

265 G. Dimitropoulos, 'Global Currencies and Domestic Regulation: Embedding through Enabling' in Hacker, Lianos, Dimitropoulos and Eich (eds), n 48 above, 112, 127.

266 For example Financial Conduct Authority (FCA), *The Impact and Effectiveness of Innovate* (London: FCA, April 2019).

267 *ibid*, 117-118.

268 Yeung, n 10 above, 208; Dimitropoulos, n 265 above, 126.

the benefits outweigh the costs.[269] Ironically, Facebook's (now abandoned) *Libra* initiative paved the way for more ambitious and comprehensive proposals.[270]

Consequently, in September 2020, the EU Commission issued its Digital Finance Package[271] with the aim to establish an 'innovation-friendly' regulatory framework 'that both enables markets in crypto-assets as well as the tokenisation of traditional financial assets and the wider use of DLT in financial services.'[272] As the centre piece of the Digital Finance Package,[273] MiCA seeks to provide a sound legal framework for cryptoassets[274] that are not covered by existing financial services legislation, and to support innovation and competition, whilst at the same time providing appropriate levels of consumer and investor protection and ensuring market integrity and financial stability in the light of global stablecoins.[275] To the extent that security tokens are subject to existing EU financial law, MiCA's scope is essentially limited to utility tokens and payment tokens.[276] For stablecoins, as a subcategory of payment tokens, MiCA distinguishes between 'asset-referenced tokens' (ARTs)[277] and 'electronic money tokens' (EMTs).[278] Cryptoassets other than ARTs and EMTs are subject to a disclosure framework.[279] ART and EMT issuers,[280] as well as cryptoasset service providers, including centralised crypto-exchanges and trading

269 D. Zetsche, D. Arner and R. Buckley, 'Decentralized Finance' March 2020, 42 at https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3539194.

270 *ibid*; D Zetsche, R Buckley and D Arner, 'Regulating Libra: The Transformative Potential of Facebook's Cryptocurrency and Possible Regulatory Responses' [2019] UNSW *Law Research Series* 47, 15-16 at http://ssrn.com/abstract=3414401.

271 European Commission, *Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions on a Digital Finance Strategy for the EU* COM(2020) 591 final.

272 European Commission, *Proposal for a Regulation of the European Parliament and of the Council on Markets in Crypto-assets and amending Directive (EU) 2019/1937* COM(2020) 593 final, 1-2.

273 The package consists of four concrete proposals: a Regulation on Markets in Crypto-assets (MiCA) (European Commission, *Proposal for a Regulation of the European Parliament and of the Council on Markets in Crypto-assets and amending Directive (EU) 2019/1937* COM(2020) 593 final); a Regulation on a pilot regime for market infrastructures based on distributed ledger technology (European Commission, *Proposal for a Regulation of the European Parliament and of the Council on a pilot regime for market infrastructures based on distributed ledger technology* COM(2020) 594 final); a Regulation on digital operational resilience for the financial sector (European Commission, *Proposal for a Regulation of the European Parliament and of the Council on digital operational resilience for the financial sector and amending Regulations (EC) No 1060/2009 (EU) No 648/2012, (EU) No 600/2014 and (EU) No 909/2014* COM(2020) 595 final); and a Regulation to clarify and amend related EU financial services rules (European Commission, *Proposal for a Directive of the European Parliament and of The Council amending Directives 2006/43/EC, 2009/65/EC, 2009/138/EU, 2011/61/EU, EU/2013/36, 2014/65/EU, (EU) 2015/2366 and EU/2016/2341* COM(2020)596).

274 Defined as a digital representation of value or rights which may be transferred and stored electronically, using distributed ledger or similar technology (MiCA, Art 3(1) No 2).

275 European Commission, n 272 above, 2-3.

276 MiCA, Art 2.

277 MiCA, Art 3 1. (3), backed by a basket of fiat currencies, commodities and/or cryptoassets.

278 MiCA, Art 3 1. (4), backed by a single fiat currency to be used as a medium of exchange.

279 MiCA, Title II (Arts 4-14). They may only be issued by a legal entity following the drafting, notification of the competent authority and publication of a white paper, benefiting from a European Passport. The issuer is subject to certain conduct of business rules and liability for inadequate disclosure.

280 EMTs can only be issued by credit institutions or e-money institutions authorised in accordance with CRD IV or the E-Money Directive, respectively; MiCA, Art 43. ART issuers are subject

platforms,[281] are subject to authorisation requirements and operating conditions. ART and EMT tokens that the EBA has deemed to be 'significant' are subject to specific risk management requirements and EBA supervision.[282]

Although there is much to be criticised,[283] it is noteworthy that the ambition is not simply to address the potential threats of global stablecoins, but to establish a functioning cryptoasset market, including for tokens referencing off-chain assets.[284] In the Commission's proposal, the regulatory linchpin remains the issuer or service provider as a legal person.[285] Given that European jurisdictions currently struggle with affording legal person status to decentralised autonomous organisations,[286] this raises the issue of whether smart contract-based stablecoins, like the MakerDAO's DAI, would even be covered.[287] Similar uncertainties arise in respect of the classification of automated market makers and liquidity pools as cryptoasset service providers. This could either be very innovation-friendly by leaving the DeFi ecosystem largely unscathed and even incentivising a move away from centralised towards decentralised exchanges[288] or innovation-stifling by forcing DeFi applications into a regulatory straight jacket or, more likely, offshore.[289] The later Compromise Proposal allows Member States to extend the Regulation's remit to 'undertakings', which are not legal persons provided 'their legal status ensures a level of protection for third parties' interests equivalent to that afforded by legal persons and that they are subject to equivalent prudential

to a bespoke own funds regime and a framework for the safeguarding of asset reserves; MiCA, Title III, Arts 15-42.

281 In the form of own funds and insurance requirements, as well as liability for the loss of cryptoassets of their clients: MiCA, Title V, Arts 53-73.

282 MiCA, Arts 41, 50-52.

283 D. Zetsche, F. Annunziata, D. Arner and R. Buckley, 'The Markets in Crypto-Assets Regulation (MiCA) and the EU Digital Finance Strategy' EBI Working Paper Series 2020 – no 77 (6/11/2020) 21-27 at https://ssrn.com/abstract=3725395.

284 European Commission, n 272 above, 1-2.

285 MiCA, Arts 3 1. (6); 15; 53.

286 S. Bayern, T. Burri, T. Grant, F. Möslein and R. Williams, 'Company law and autonomous systems: a blueprint for lawyers, entrepreneurs, and regulators' (2017) 9 *Hastings Science and Technology Law Journal* 135.

287 Recourse could be had to the Maker Foundation that bootstrapped the MakerDAO, but given the current level of decentralisation (the holders of the MKR governance token vote on changes to the governance variables and financial parameters of the Maker protocol; https://makerdao.com/en/whitepaper#use-of-the-mkr-token-in-maker-governance) and automation (anyone can open a 'vault' to deposit ETH and generate DAI by directly interacting with the Maker protocol; the user retains complete and independent control of their deposited collateral as long as the value of the collateral does not fall below the minimum level, in which case the protocol automatically auctions off the collateral; https://makerdao.com/en/whitepaper#interacting-with-a-maker-vault) it would seem a stretch to say that it is the Foundation that 'offers' DAI tokens to the public. Regulators may adopt an approach similar to that taken by the SEC in the course of The DAO debacle, where the founders' managerial efforts were deemed essential to the enterprise (SEC, n 265 above, 12-15). However, the normative context of the *Howey* test (*SEC* v *W.J. Howey Co* 328 U.S. 293, 301 (1946)) relied on by the SEC is radically different from the delineation of MiCA's scope of application.

288 Pursuant to MiCA, Art 68(8), cryptoasset transactions must be settled on the ledger on the same date a trade has been executed. This may significantly increase the costs of trading through centralised exchanges.

289 Following the enactment of New York's BitLicence Law, the state experienced an exodus of (smaller) blockchain firms; although many larger well-funded players use it as a base. See Werbach, n 59 above, 175-177.

supervision appropriate to their legal form'.[290] This could open up a space for local experimentation with the envisaged 'equivalent status'. Some DeFi applications and their users may prefer the enhanced credibility of operating within a statutory framework mandated in the Member States that make use of this option. As it stands, it remains unclear whether, under this draft, relevant DeFi applications will have more room to innovate in Member States that do not provide for 'equivalent status' or whether they will be forced to incorporate or emigrate.

In any case, these and other initiatives demonstrate the regulatory state's preparedness to enact comprehensive and bespoke measures to address the most pressing policy issues raised by new technologies[291] with a view to facilitating their adoption. The necessary adjustment of private and commercial law, based on a case-by-case negotiation of legal concepts[292] over centuries and/or codifications perceived as monuments of legal culture within a jurisdiction, takes longer. These areas of law are not susceptible to rapid adaptations and accommodation of new technologies.[293] Blockchain-related statutory ventures into this space to date have been limited.[294] With cryptoassets gaining popularity, it is inevitable that fundamental legal issues of general private and commercial law will become important. For example, whether and to what extent cryptoassets should be treated as 'property' is relevant in a wide range of contexts, including the law of succession, matrimonial/family law, and insolvency law.[295] In recent years, this issue and related considerations have received significant attention, if not by courts,[296] then at least by policymakers and scholars.[297] As eminent legal historian J.H. Baker writes, '[a]ll systems of law must take notice of the way affairs are conducted and the general assumptions of mankind'. The problem

290 Council of the European Union, *Proposal for a Regulation of the European Parliament and of the Council on Markets in Crypto-assets, and amending Directive (EU) 2019/1937 – Mandate for negotiations with the European Parliament* Interinstitutional File: 2020/0265 (COD) of 19 November 2021, Arts 15, 53.

291 Brownsword (2019), n 48 above 12.

292 Pistor (2019), n 58 above, 28.

293 Brownsword (2019), n 48 above, 11-12.

294 F. Möslein, 'Conflicts of Laws and Codes – Defining the Boundaries of Digital Jurisdiction' in Hacker, Lianos, Dimitropoulos and Eich (eds), n 48 above, 275, 279.

295 The LawTech Delivery Panel, *Legal statement on cryptoassets and smart contracts* (November 2019) para 36-37.

296 *AA* v *Persons Unknown* [2019] EWHC 3556 (Comm); *Fetch.IA* v *Persons Unknown* [2021] EWHC 2254 (Comm); *Wang* v *Darby* [2021] EWHC 3054 (Comm): Cryptoassets as property under English law; further *Liam David Robertson* v *Persons Unknown* CL-2019-000444 unreported, 15 July 2019; *Vorotyntseva* v *Money-4 Limited, trading as Nebeus.com* [2018] EWHC 2598 (Ch); *B2C2 Limited* v *Quoine PTC Limited* [2019] SGHC (I) 03; *Ruscoe* v *Cryptopia Ltd (in Liquidation)* [2020] NZHC 728. See also Tokyo District Court, Reference number 25541521, Case claiming the bitcoin transfer, etc, Tokyo District Court, Heisei 26 (Year of 2014), (Wa)33320, Judgement of Civil Division 28 of 5 August 2015 (Year of Heisei 27), Date of conclusion of oral argument; 10 June 2015, translation at https://www.law.ox.ac.uk/sites/files/oxlaw/mtgox_judgment_final.pdf; Ninth Arbitrazh Court of Appeals (No 9AP-16416/18 in Case No A40-124668/17, 15 May 2018).

297 J. Sarra and L. Gullifer, 'Crypto-claimants and bitcoin bankruptcy: Challenges for recognition and realization' (2019) 28 *International Insolvency Review* 233; The LawTech Delivery Panel, n 295 above; The Law Commission, n 210 above.

is 'the inevitable time-lag between the invention of new ways of conducting business, or holding wealth, and their recognition in legal form'.[298]

In this vein, a number of jurisdictions have begun to enact general private and commercial law statutes with a view to accommodating blockchain-based property rights. The Liechtenstein Law on Token and Trusted Technology Providers of 3 October 2019 (TVTG) entered into effect on 1 January 2020.[299] It seeks to provide the private law foundations of tokens, the representation of rights through tokens and their transfer, as well as the supervision of trusted technology providers.[300] With a view to enabling blockchain-based securities, Switzerland has amended its Law of Obligations (OR) and various other statutes, which entered into effect on 1 February 2021.[301] The reform introduced the new category of the 'registered value right' (*Registerwertrecht*, RWR) as a right that is recorded in a 'register for value rights' (*Wertrechtsregister*, WRR)[302] and that can only be invoked and transferred through this register. These systems bring the treatment of cryptoassets closer to that of traditional bearer instruments.[303]

Inevitably, these early attempts have their weaknesses. Ledger integrity is limited: although transferees and issuers of tokens can rely on the outward appearance of the recorded information, provided they are in good faith,[304] token transfers and dispositions are not exclusively governed by the blockchain protocol. In both systems, the underlying agreement between the parties which exists by necessity off-chain will be significant;[305] any defects in this agreement may result in registration being challenged and/or being subject to restitutionary claims.[306] There is also the recognition, in Liechtenstein, that a token transfer may not be sufficient to transfer the represented entitlement;[307] and in

298 J. Baker, '"Law Merchant" as a Source of English Law' in J. Baker, *Collected Papers on English Legal History* (Cambridge: Cambridge University Press, 2013) 1263, 1269.

299 Gesetz vom 3. Oktober 2019 über Token und VT-Dienstleister (TVTG), Liechtensteinisches Landesgesetzblatt Nr 301 (2 Dezember 2019).

300 TVTG, Art 1 and 2. A 'token' is information in a trusted technology system that can represent cash flow or membership rights against an issuer, rights in tangible property or other absolute or relative rights, and can be uniquely attributed through trusted technology identification. Trusted technologies are defined as technologies that ensure the integrity of tokens, their unique identification and transfer.

301 Bundesgesetz zur Anpassung des Bundesrechts an Entwicklungen der Technik verteilter elektronischer Register vom 25 September 2020, BBl 2020, 7801.

302 A WRR requires that only the holder (creditor) of a RWR, not the debtor or issuer, has authority to dispose of the RWR through a technological process; the WRR's integrity is ensured trough appropriate technological and organisational measures, such as the common administration through independent participants; OR, §973d.

303 Werbach, n 43 above, 9: a 'digital coin is a bearer instrument.' See further the Law Commission, n 210 above.

304 TVTG, Arts 5, 7, 8, 9; OR, §973e.

305 Under Swiss law, the transfer of a RWR is governed exclusively by the rules of the agreement between the parties underpinning the registration: OR, §973f. Under Liechtenstein law, a disposition of a token requires a transfer in accordance with the rules of the trusted technology system, agreement between transferor and transferee, and the transferor's right to dispose of the token, subject to the protection of the bona fide transferee: TVTG, Art 9.

306 Under Liechtenstein law, a token transfer that has been effectuated without an underlying legal ground will be subject to a restitutionary retransfer based on rules for unjust enrichment: TVTG, Art 6.

307 In these cases, the transferor is obliged to ensure that a transfer of the represented right does occur off-chain and to prevent any conflicting transaction: TVTG, Art 7.

Switzerland, RWRs are subject to defenses arising from a personal relationship between a debtor and the holder or previous holders.[308] These limitations introduce significant uncertainty into the system, but perhaps no more than is common in traditional title registration systems.

Currently, both regimes are limited to permissioned blockchains, based on public authorisation and supervision.[309] This may facilitate the rollout of blockchain technology through regulated entities in traditional financial markets, helping the innovation up the slope of enlightenment. However, much of the DeFi ecosystem remains outside these new legal frameworks; the lure of legal certainty may have limited pull for these highly innovative communities. In the end, only practical uptake and experience will show whether and to what extent these frameworks are fit for purpose.

CONCLUSION: TOWARDS THE PLATEAU OF PRODUCTIVITY?

So where are we on blockchain technology's legal hype cycle? It has been said that 'blockchain is not a "disruptive" technology, which can attack a traditional business model with a lower-cost solution and overtake incumbent firms quickly'. Rather, it is 'a foundational technology: it has the potential to create new foundations for our economic and social systems'.[310] Like the internet protocol TCP/IP, which took more than 30 years to eventually reshape the economy, it may take blockchain decades to seep into society's economic and social infrastructure through gradual and steady adoption.[311] Institutional change almost always occurs incrementally and at the margins over extended periods of time.[312] In other words, blockchain technology is a long-fuse innovation. We can expect a long trough of disillusionment and a very gradual climb up the slope of enlightenment so that after more than a decade since Bitcoin's inception we may be just beginning to approach the ascent.

During this time Bitcoin's 'modest' peer-to-peer online payment system has spawned an entire new ecosystem of blockchain platforms and decentralised applications. An ever-increasing amount of value is locked up in, and

308 The transferee of a RWR from a registered holder enjoys bona fide purchaser protection. However, a claim embodied in a RWR is subject to a limited number of defenses: those challenging the validity of the registration or emanating from the register itself; personal defenses of the issuer against the current holder; those emanating from the relationship of the issuer to previous holder, provided the current holder acted knowingly to the debtor's/issuer's detriment when acquiring the RWR: OR, §973e.

309 The providers of trusted technology systems with a seat in Liechtenstein are subject to registration with, and supervision by, the Financial Market Authority: TVTG, Arts 11-49. The Swiss Act on Financial Market Infrastructures has introduced the new category of 'DLT trading system' for the trading of 'DLT securities' in the form of RWRs and other rights held through distributed ledger technology. DLT trading systems are subject to general requirements for financial market infrastructures and supervision by FINMA; the participants in a DLT trading system are subject to authorisation by FINMA: Finanzmarktinfrastrukturgesetz, Art 73a-73f.

310 M. Iansiti and K. Lakhani, 'The Truth About Blockchain' (2017) *Harvard Business Review* at https://hbr.org/2017/01/the-truth-about-blockchain.

311 *ibid*; Werbach, n 59 above, 225-226, 246.

312 North, n 83 above, 101.

generated through, these systems, supported by a multitude of new business models of which some are more sustainable than others. This is a sign of a maturing innovation.[313]

The law seems to be catching up quickly. From a regulatory perspective, the wait-and-see approach of incrementally extending existing legal frameworks is being replaced by a more comprehensive outlook, aiming to develop bespoke regulatory regimes for DLT/blockchain value transfer systems. Even in general private and commercial law there is significant movement, with some jurisdictions starting to enact statutory amendments with a view to facilitating the tokenisation of on-chain and off-chain assets as well as their transfer and use as collateral. The ensuing legal certainty may accelerate the pace of blockchain adaption for ventures such as the Swiss Digital Exchange.

When reaching the plateau of productivity, hype is typically replaced by a solid body of knowledge and a focus on best practices.[314] We are not there yet. Technological experimentation continues, in particular in the fast-expanding DeFi ecosystem, as does legal experimentation through the newly emerging legal and regulatory frameworks. These will have to be tried and tested, their direct and more remote consequences explored and assessed.[315] Thus, although the plateau of productivity may still be quite distant, the legal discourse concerning blockchain technology should continue, even if the innovation does not live up to (legal) expectations in the short and medium term. This is one of the key lessons of the legal hype cycle.[316]

313 Fenn and Raskino, n 16 above, 85.
314 *ibid*, 85.
315 *ibid*, 83.
316 *ibid*, 86.